DC-8/DC-8 PRO/DC-8 CV/DC-8 EXP/DC-8S

Diagnostic Ultrasound System

Service Manual

（Advanced）

Revision 11.0

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Appendix C Description of Self-diagnosis Test Items C-1

Revision History

Mindray may revise this publication from time to time without written notice.

Revision	Date	Reason for Change
1.0	2011.11.25	Initial release
2.0	2012.2.27	1. Modify the content of “12 Preventive Maintenance” and let it more practical. 2. Increase detailed picture and description of “6.2.1.2 Operation System and Doppler restoration”. 3. In chapter “8 Field replaceable Unit”, replace the picture of hard disk and change the name of “Control Panel Assembly” into “Top Cover of Keyboard Assembly”. 4. Delete the “Reserved” description of audio and video in “1.2.3 General Symbols”. 5. Modify several clerical errors in the initial release.
3.0	2012.4.11	1. Modify the requirement of maintenance operator in “5.1” and “12.3.5”. 2. Increase the up/down dragline adjustment method in “7.5”. 3. Increase the disassembling and assembling method of gas spring assembly in 9.3.12.4.
4.0	2012.11.30	1. Increase the note “Calibrate the touch screen after the system software is upgraded or recovered” in 7.2.2. 2. Increase 9.3.12.5 the disassembling and assembling method of monitor support arm. 3. Increase C.1.21~C.1.46 self test items in Appendix C.
5.0	2013.03.12	Monitor replacement 1. Modify “4.6 Fig 4-21 Main Monitor Unit” schematic diagram. 2. Modify procedure description in 7.1.2 3. Modify monitor assembly procedure 9.3.10
6.0	2013.04.11	1. Modify installing notification for 4D mode in chapter 10.2.2（4D option does not require DSP board since 02.00.00 version）; 2. Add 2.1.3 printer model（MITSUBISHI P95DW-N, Canon selphy CP800）; 3. Modify 2.1.3 footswitch model description 4. Add Appendix C.1.1 item; 5. Add Restore package checking tool 6.2.3 6. Add pencil probe cable installing method 10.2.1 7. Change HDD FRU part number (old number is to be used for SFDA region only, add CE/FDA region number)
7.0	2013.08.20	1. Self-diagnosis test description modification 2. Chapter 10.2, 9.3.2 ECG module photo update 3. Change 11.2 windows startup picture.
8.0	2014.1.15	Add the order number and disassembly of monitor’s front cover.
9.0	2014.9.12	1. Add DC-8 EXP control panel figure in 2.1.2.4; 2. Add FRU of PC module assembly, digital board assembly, COM module, keyboard and top cover assembly, control panel top cover

		and digital board assembly in 8 chapter. 3. In 9.3.6, add digital board assembly and COME module assembly procedure for DC-8 EXP 4. 9.3.9.7 chapter add digital keyboard assembly procedure for DC-8 EXP. 5. Update appendix C self-diagnosis chapter. 6. 10.2.7 chapter updates gel warmer cable connection description. 7. 10.1 chapter adds Promote function description.
10.0	2015.3.26	1. 2.1.3 add video printer UP-X898MD and UP-D898MD, and mark the printers that is supported only on XP operating system. 2. 3.4.3.3 wireless printer is not supported by the DC8 series products later than V4.0. 3. 3.5.5 update the descriptions and screen shots for wireless network settings. 4. 3.5.7 Update the picture for Setup-About page。 5. Chapter 8: add to PC FRUs, and delete the old PC FRU used for DC8 EXP which is no longer served as FRU. 6. Add digital board FRU used on non-EXP in Win7. 7. Add Hard disk used in OS Win7 for DC-8 non-EXP and EXP in the region of CE/FDA/India/Russia & CIS. 8. 10.1 Add picture of the screen for Promote function. Update screen picture for uninstalling the options. 9. In section 9.3.6.2, 9.3.9.7 and 10.2.1, change the steps for DC-8 EXP only or for non DC-8 EXP only to “for win7” and “for XP”.
11.0	2015.5	1. Section 10.2, change part number and picture of the gel warmer. Section 10.2.7 change pictures in step of installing the gel warmer. 2. Section 11.1.5, add the status indicator of the gel warmer. 3. Section 11.3.6, add the abnormality of the gel warmer.

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Applicable for

This service manual is applicable for the service engineers, authorized service personnel and service representatives of this ultrasound system.

Statement

This service manual describes the product according to the most complete configuration; some of the content may not apply to the product you are responsible for. If you have any questions, please contact Mindray Customer Service Department.

Do not attempt to service this equipment unless this service manual has been consulted and is understood. Failure to do so may result in personnel injury or product damage.

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Mindray is responsible for the effects on safety, reliability and performance of this product, only if:

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- The product is used in accordance with the instructions for use.

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- Any Mindray product from which Mindray's original serial number tag or product identification markings have been altered or removed;
- Any products of any other manufacturers.

⚠**WARNING:**	**It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or injury of human health.**

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1 Safety Precautions

This chapter describes important issues related to safety precautions, as well as the labels and icons on the ultrasound machine.

1.1 Meaning of Signal Words

In this operator's manual, the signal words ⚠**DANGER**, ⚠**WARNING**, ⚠**CAUTION** and **NOTE** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
⚠**DANGER**	**Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.**
⚠**WARNING**	**Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.**
⚠**CAUTION**	**Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.**
NOTE	Indicates a potentially hazardous situation that, if not avoided, may result in property damage.

1.2 Symbols

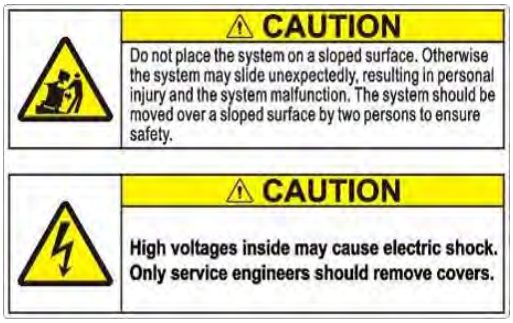
The following tables provide location and information of the safety symbols and warning labels, please read carefully.

1.2.1 Meaning of Safety Symbols

Symbol	Meaning	Position
	Type-BF applied part The ultrasound transducers connected to this system are type-BF applied parts. The ECG module connected to this system is Type-BF	On the right side of I/O Panel

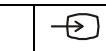
	applied part.	
	"Attention" indicates the points that you should pay attention to. Before using the system, be sure to carefully read the relevant contents of this operator's manual.	

1.2.2 Warning Labels

Symbol	Meaning	Position
(a) (b) (c)	(a) Do not sit on the system.	General Warning Labels On the upper left corner of the control panel
	(b)Be sure to read the Operator's Manual concerning these points before using the system.	
	(c)DANGER: There is explosion risk if the system is used in flammable anesthetics.	
	(a) Do not place the system with the mobile trolley on a sloped surface. Otherwise the system may slide, resulting in personal injury or the system malfunction. Two persons are required to move the system over a sloped surface.	On the cable cover behind the display
	(b) CAUTION: Do not open the system covers, because the high voltage inside may cause electric shock. Only maintenance engineer is allowed to open the covers.	
	Beware of excessive stress exerted to the system.	On the upper left corner of the control panel

1.2.3 General Symbols

This system uses the symbols listed in the following table, and their meanings are explained as well.

No.	Symbol	Description
1		Type-BF applied part
2		Refer to relevant content in the Operator's Manual, to avoid safety accidents
3		Dangerous voltage
4		AC (Alternating current)
5		Functional grounding
6		Equipotentiality
7		protective earth
8		Circuit breaker ON/OFF
9		Power button
10		Footswitch
11		Transducer sockets
12		Network port
14		Serial port
16		Connects the control port of the video printer
17		USB port
18	DVI-D	Used for DVI-D signal output.
19	VGA	Used for VGA output.
22	S-VIDEO 	Reserved, used for separate video input
23		Reserved, used for separate video output
24	AUDIO	Reserved, used for stereo audio input.
25		Reserved, used for stereo audio output.
26	VIDEO	Reserved, used for composite video input
27		Reserved, used for composite video output
28	HDMI	High definition multimedia interface.
30		Microphone input jack
31		When the lever located at the bottom of the monitor support arm points to , you can move the monitor to the right and left.

No.	Symbol	Description
32		When the lever located at the bottom of the monitor support arm points to , the supporting arm is fixed at the middle position.
33		Product serial number
34		Manufacture date

1.3 Safety Precautions

Please read the following precautions carefully to ensure the safety of the patient and the operator when using the probes.

⚠DANGER **Do not operate this system in an atmosphere containing flammable or explosive gases such as anesthetic gases, oxygen, and hydrogen or explosive fluid such as ethanol because an explosion may occur.**

1.3.1 Electric safety

⚠WARNING:

1. **Connect the power plug of this system and power plugs of the peripherals to wall receptacles that meet the ratings indicated on the rating nameplate. Using a multifunctional receptacle may affect the system grounding performance, and cause the leakage current to exceed safety requirements. Use the power cord accompanied with the system provided by Mindray.**
2. **Disconnect the AC power before you clean or uninstall the ultrasound machine, otherwise, electric shock may result.**
3. **In maintenance or assembly/disassembly, make sure other cables are connected well before the battery connecting cable is connected, otherwise the system may be damaged due to hot-plug.**
4. **Do not use this system simultaneously with equipment such as an electrosurgical unit, high-frequency therapy equipment, or a defibrillator, etc.; otherwise electric shock may result.**
5. **This system is not water-proof. If any water is sprayed on or into the system, electric shock may result.**

⚠CAUTION:

1. **DO NOT connect or disconnect the system's power cord or its accessories (e.g., a printer or a recorder) without turning OFF the power first. This may damage the system and its accessories or cause electric shock.**
2. **Avoid electromagnetic radiation when perform performance test on the ultrasound system.**

3. **In an electrostatic sensitive environment, don't touch the device directly. Please wear electrostatic protecting gloves if necessary.**
4. **You should use the ECG leads provided with the ECG module. Otherwise it may result in electric shock.**

1.3.2 Mechanical safety

⚠WARNING:

1. **Before moving the system, please hold the handle. If other parts of the system are held, it may cause damage due to the abnormal force. Do not push the system from the left/right side; otherwise, it may be toppled over.**
2. **Do not subject the transducers to knocks or drops. Use of a defective probe may cause electric shock to the patient.**

⚠CAUTION:

1. **Fasten and fully secure any peripheral device before moving the system, gently and carefully move the system to avoid falling over.**
2. **Do not expose the system to excessive vibration (during the transportation) to avoid device dropping, collision, or mechanical damage.**
3. **Please install the system on a flat plane with the four casters locked. Otherwise, damage may be resulted by accidental moving.**
4. **Pay extra attention when moving the system on a sloping ground, do not move it on a more than 10°-sloped plane to avoid system toppling.**
5. **Move the system ONLY WHEN the system is shut down or in standby status, otherwise the system hardware disk may be damaged.**

1.3.3 Personnel Safety

NOTE:

1. The user is not allowed to open the covers and panel of the system, neither device disassemble is allowed.
2. To ensure the system performance and safety, only Mindray engineers or engineers authorized by Mindray can perform maintenance.
3. Only technical professionals from Mindray or engineers authorized by Mindray after training can perform maintenance.

1.3.4 Other

NOTE:	For detailed operation and other information about the ultrasound system, please refer to the operator's manual.

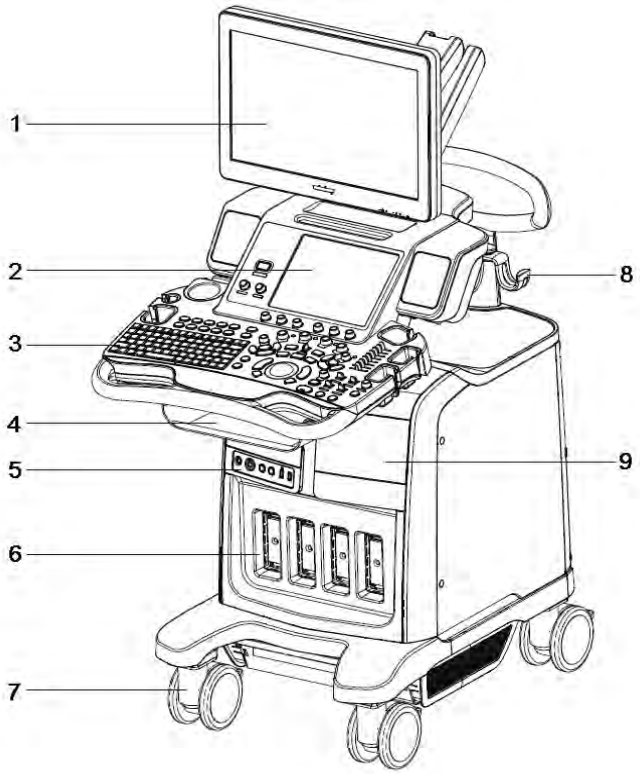
2 Specifications

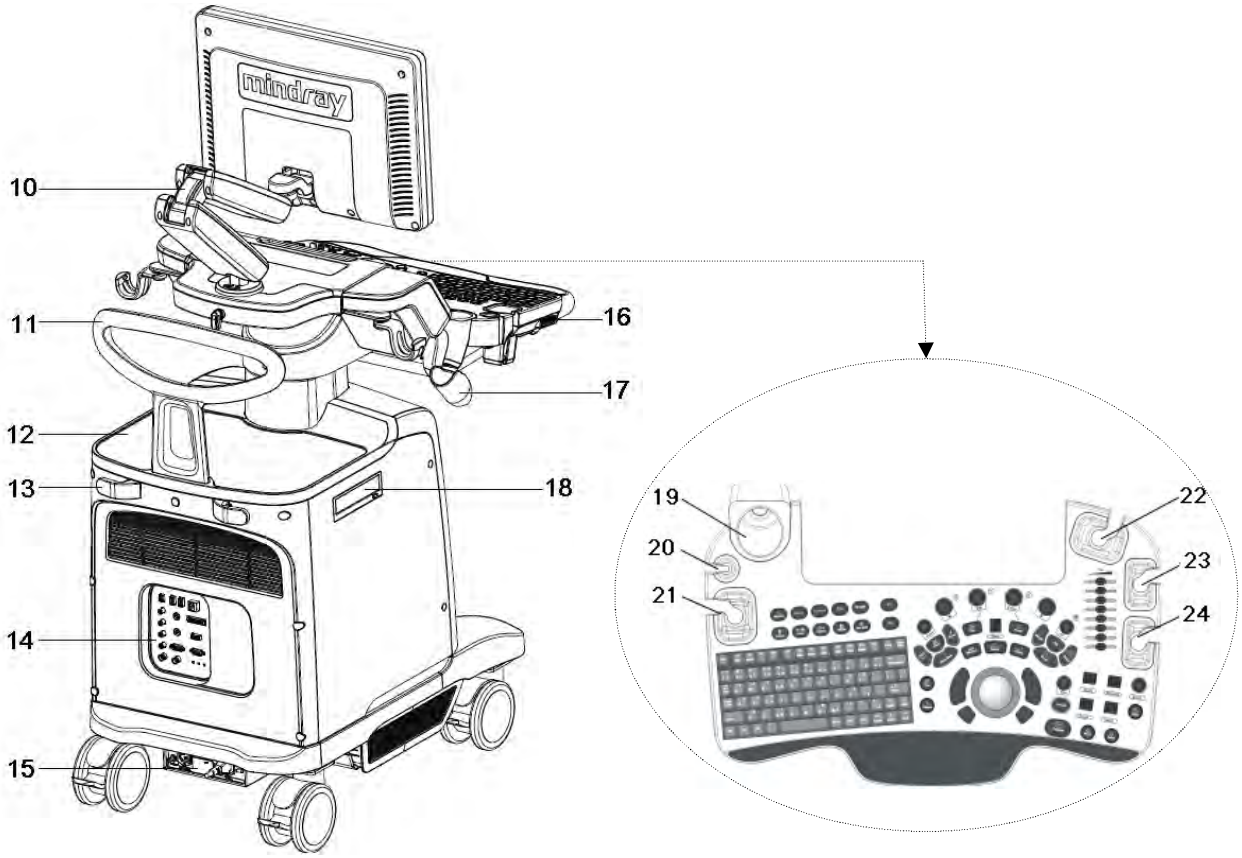
2.1 Overview

2.1.1 Intended Use

The DC-8/DC-8 PRO/DC-8 CV/DC-8 EXP/DC-8S diagnostic ultrasound system is intended for use in clinical ultrasonic diagnosis.

2.1.2 Introduction of Each Unit



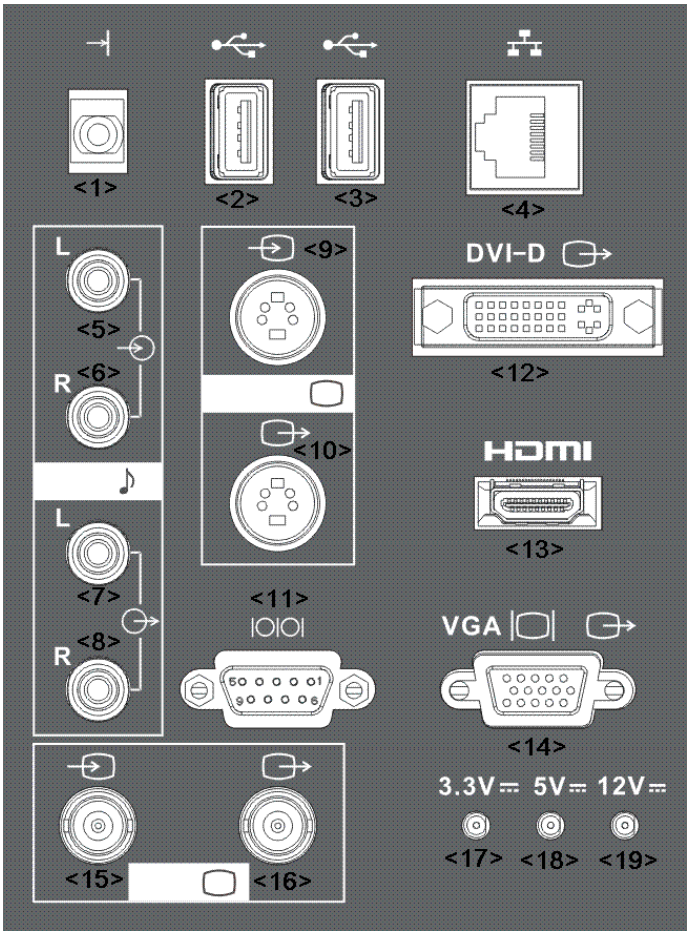


No.	Name	Function
1.	Monitor	Displays the images and parameters during scanning.
2.	Touch screen panel	Operator-system interface or control.
3.	Main control panel	Operator-system interface or control.
4.	Storage compartment	Used for placing small objects.
5.	Physio panel	Used for connecting the ECG leads, PCG transducer, footswitch, external ECG device and PCG signal etc.
6.	Probe port	Sockets connecting transducers and the main unit.
7.	Caster	Used for securing or moving the system
8.	Probe cable hook	Used for fixing the probe cable.
9.	Compartment	Used for placing B/W video printer.
10.	Monitor support arm	Supports the monitor, for adjusting the height and position of the monitor.
11.	Rear handle	Used for pushing and moving the system.
12.	Color video printer placing table	Used for placing the color video printer
13.	Hanger	/
14.	I/O Panel	Interface panel used for inputting and outputting signals.
15.	Power supply panel	Electrical port panel.

2-2 Specifications

16.	USB_MIC port	USB port and MIC port.
17.	Endocavity probe holder	Used for fixing the endocavity probe.
18.	DVD-RW	DVD-RW drive.
19.	Ultrasound gel holder/ gel heater	Used for placing the ultrasound gel or installing the gel heater.
20.	Pencil probe holder	Reserved.
21.	Probe holder	Used for placing general probe, endocavity probe or 4D volume probe.
22.	Probe holder	
23.	Probe holder	Used for placing general probe.
24.	Probe holder	Used for placing general probe.

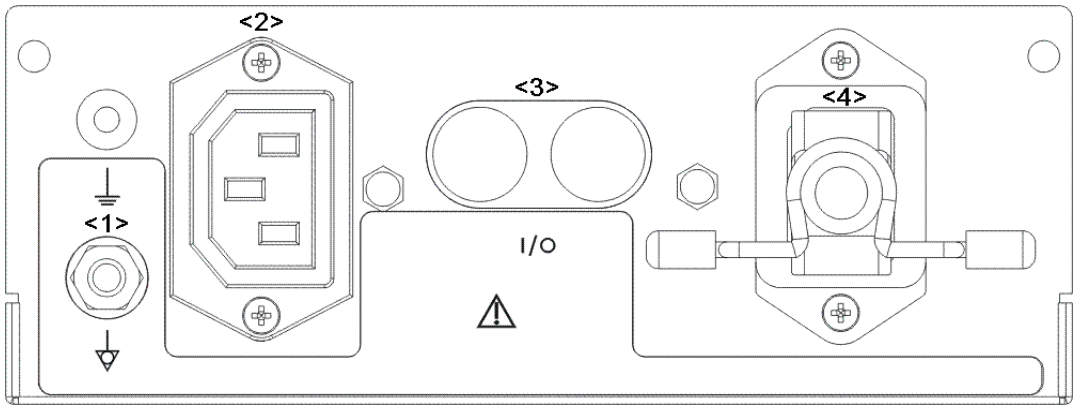
2.1.2.1 I/O panel



No.	Symbol	Function	Property
1.	→|	Connects the control port of the video printer	/

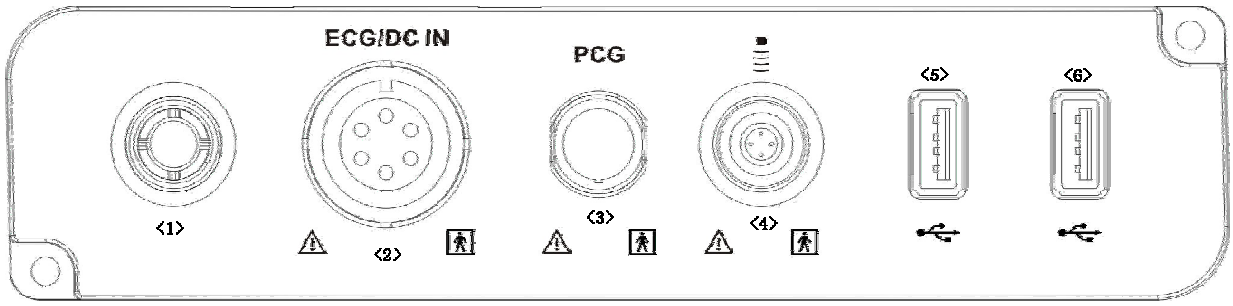
2. 3.			USB ports	Support USB2.0
4.			Network port	Support 10/100/1000Mbit Ethernet
5.			Audio signal input port, left channel.	Reserved
6.			Audio signal input port, right channel.	Reserved
7.			Audio signal output port, left channel.	/
8.			Audio signal output port, right channel.	/
9.	S-VIDEO		Used for separate video input	Reserved, suppoty PAL and NTSC. Using standard S-Video socket
10.			Used for separate video output.	
11.			Serial port, connects the serial port devices.	Standard serial port
12.	DVI-D		Used for DVI-D signal output.	DVI output resolution and content is the same as of the main monitor.
13.	HDMI		High definition multimedia interface.	Standard HDMI Type A port
14.	VGA		VGA signal output.	VGA output resolution and content is the same as of the main monitor.
15.	VIDEO		Used for composite video input.	Reserved, support PAL and NTSC。 Using standard BNC connector.
16.			Used for composite video output.	
17.	/		3.3V power indicator.	/
18.	/		5V power indicator.	/
19.	/		12V power indicator.	/

2.1.2.2 Power Supply panel



No.	Name	Function
1	Equipotential terminal	Used for equipotential connection, that balances the protective earth potentials between the system and other electrical equipment.
2	Power outlet	Supply power for optional peripheral devices.
3	Circuit breaker	Used for switching off/ on the power supply.
4	Power inlet	AC power inlet.

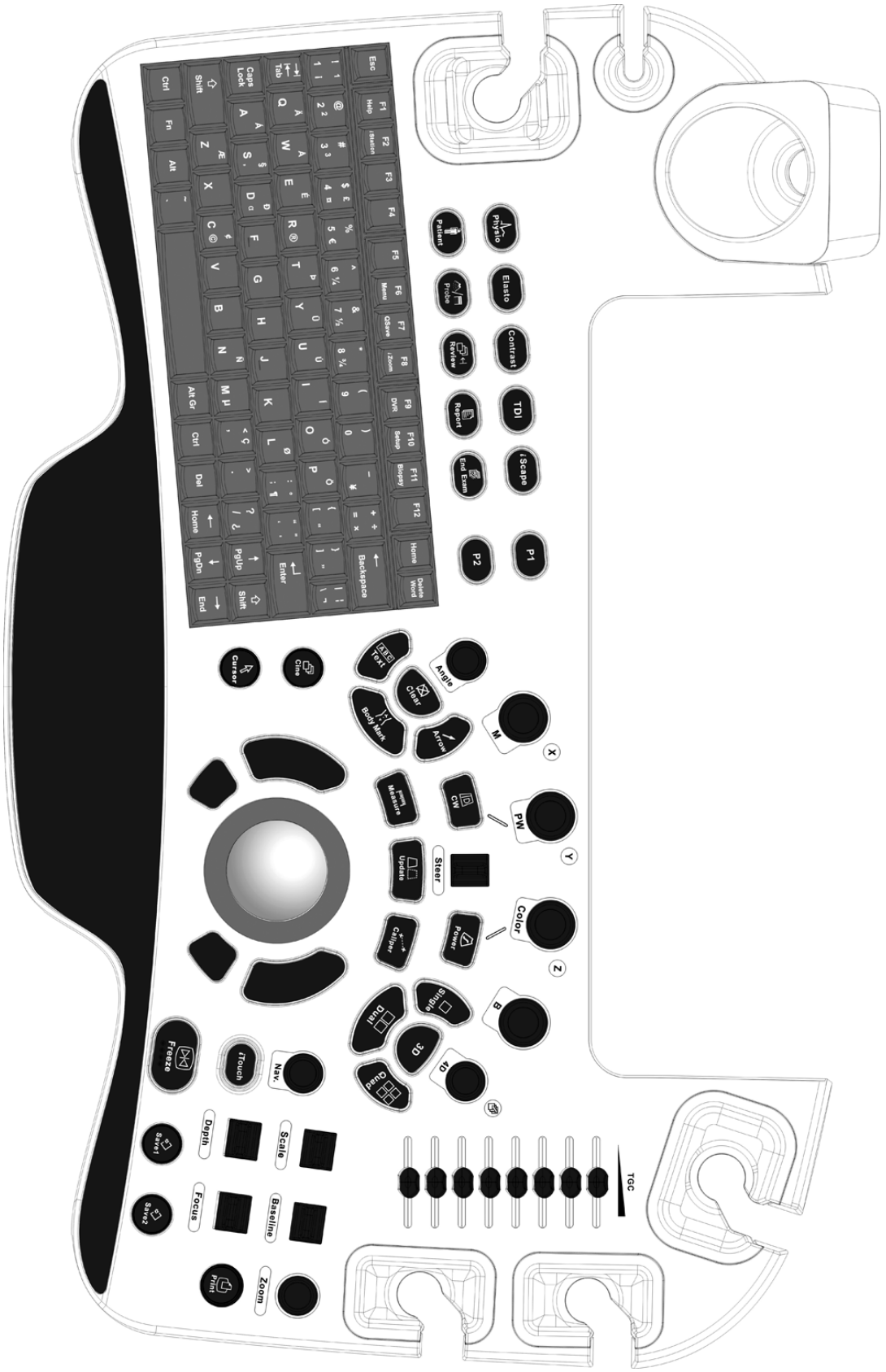
2.1.2.3 Physio Panel (ECG & PCG)



No.	Name	Function
<1>	Reserved port	Port for reserved function.
<2>	ECG lead signal input port / external ECG signal input port	Connects to ECG leads, to directly obtain the ECG signals of the patient. Connects the signal output port of external ECG monitoring device.
<3>	PCG signal input port	Connects to PCG transducer, to directly obtain the PCG signals of the patient.
<4>	Pencil probe port	Used for connecting a pencil probe.
<5>/<6>	USB ports	Connects USB devices.

2.1.2.4 Control Panel

- DC-8/DC-8 PRO/DC-8 CV/DC-8S



- DC-8 EXP

Esc
Tab
Caps Lock
Shift
Ctrl
Alt
Alt Gr
Del
Back
Enter
Patient
Physio
Probe
Elasto
Review
Contrast
Report
TDI
End Exam
iScape
P2
P1
Cursor
Glide
Text
Clear
Body Mark
Angle
Arrow
M
X
Measure
CW
PW
Y
Update
Steer
Caliper
Power
Color
Z
Single
Dual
3D
Quad
B
Freeze
iTouch
Nav
Depth
Scale
Store1
Store2
Focus
Baseline
Print
Zoom
TGC

Exam Operation

Symbol	Name	Control Type	Function
	End Exam	Functional button	End the current exam.
	Patient Information	Functional button	Enter/ exit Patient Info screen.
	Probe/Exam switch	Functional button	Switch probe and exam mode.
	Review	Functional button	Enter/ exit the Review screen.
	Report	Functional button	Open/ close the exam report.
	/	Functional button	Enter/ exit the Patient Info system.

Cursor Operation

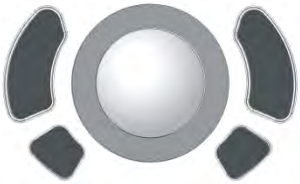
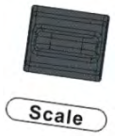
Symbol	Name	Control Type	Function
	/	Trackball Confirm key	Move the trackball to change the cursor position. Select functions. The left/right kidney shaped key is the <Set> key.
	Cursor	Functional button	Show/ hide the cursor.
	Navigation	Pressable knobs	Multifunctional knob

Image operations

Symbol	Name	Control Type	Function
	/	Pressable knobs	Press to enter B mode; Rotate to adjust B mode gain.
	/	Pressable knobs	Press to enter M mode, and rotate to adjust M gain; while in 3D/4D mode, rotate the knob to make the 3D image to rotates around X axis.
	/	Pressable knobs	Press to enter Color mode, and rotate to adjust Color or Power gain; while in 3D/4D mode, rotate the knob to make the 3D image to rotate around Z axis.
	/	Key	Enter Power mode.
	/	Pressable knobs	Press to enter PW mode, and rotate to adjust PW or CW gain; while in 3D/4D mode, rotate the knob to make the 3D image to rotate around Y axis.
	/	Key	Enter CW mode.
	/	Key	Enter elastography.
	/	Key	Enter iScape.
	/	Key	Enter 3D imaging function: Smart 3D or Static 3D.
	/	Pressable knobs	Press to enter 4D function; rotate to make the 3D image rotation.

	/	Key	Enter TDI imaging.
	/	Key	Enter contrast imaging.
	/	Undefined Button	Undefined Button, set by the user in preset.
	/	Undefined Button	Undefined Button, set by the user in preset.
	/	Functional button	Enter single window in multiple window mode.
	/	Functional button	Enter Dual mode in Non-Dual mode; Switch between the two display windows in Dual mode.
	/	Functional button	Enter Quad mode in Non-Quad mode; Press to switch among the display windows in Quad mode.
	/	Functional button	Switching key: Press to change the currently active window. Start/ stop image acquisition in iScape or 3D/4D mode.
	Cine Review	Functional button	Enter/ exit the Cine Review status.
/	Save 1/ Save 2	Functional button	Save images in a way as preset.

Parameter Adjustment

Symbol	Name	Control Type	Function
	Depth	Deflector rod	Adjust depth in real-time imaging.
	Zoom	Pressable knobs	Rotate to enter the pan zoom mode, and press to enter the spot zoom mode.
	/	Slide bar	Adjust the depth gain.
	Angle	Functional button	Adjust angle.
	/	Deflector rod	Activate the steer function for linear probe.
	/	Deflector rod	Adjust scale parameter.
	/	Deflector rod	Adjust baseline parameter.
	/	Deflector rod	Change the focus position.
	/	Functional button	Optimize the image.

Measurement, Comment, and Body Mark Operations

Symbol	Name	Control Type	Function
	Measurement	Functional button	Enter or exit the general measurement mode.
	Caliper	Functional button	Enter/ exit the application measurement mode.
	Comment	Functional button	Enter/ exit the textual comment status.
	Arrow	Functional button	Enter/ exit the arrow comment status.
	Delete	Functional button	Clear the measurement caliper, comments and body mark. Press <Clear> to clear the selected item, return to the previous operation or to delete the last project. Long press <Clear> to delete the mode related elements or all elements on the screen.
	Body Mark	Functional button	Enter/ exit Body Mark.

Other Operations

Symbol	Name	Control Type	Function
	/	Functional button	Enter/ exit ECG, PCG control screen.
	Print	Functional button	Print.
	Freeze	Functional button	Freeze/ unfreeze the image.

For user-defined keys, please refer to the user manual.

2.1.3 Peripherals Supported

No.	Name	Model
1.	Footswitch	971-SWNOM 2-pedal USB Footswitch 971-SWNOM 3-pedal USB Footswitch
2.	Black/white video printer	Analog：SONY UP-897MD, SONY UP-D898MD, MITSUBISHI P93W-Z Digital：MITSUBISHI P93DC, SONY UP-D897, MITSUBISHI P95DW-N SONY UP-X898MD
3.	Color video printer	Analog: SONY UP-20, MITSUBISHI CP910E* Digital: SONY UP-D25MD, Sony UP-D23MD*, Canon selphy CP800*
4.	Graph/text printer	HP Officejet6000 HP Officejet7000 HP Color LaserJet CM1015 HP Deskjet 1280* HP Office 3600* HP Officejet 6000 E609a* Epson office 85ND*
5.	Bar code reader	SYMBOL LS2208-SR

Note: printers marked with * are supported by the XP operating system only.

2.2 Specifications

2.2.1 Dimensions & Weight

Dimension: 1355~1800mm (H)×930mm (D)×585mm (W)
Net weight: about 120Kg

2.2.2 Electrical Specifications

2.2.2.1 AC Input

Voltage	220-240～,100-127V～
Frequency	50/60Hz
Power consumption	800VA

2.2.2.2 Battery

Voltage	11.1V

Capacity	4800mAh

2.2.3 Environmental Conditions

	Operating conditions	Storage and transportation conditions
Ambient temperature	0℃～40℃	-20℃～55℃
Relative humidity	30%～85% (no condensation)	30%～95% (no condensation)
Atmospheric pressure	700hPa～1060hPa	700hPa～1060hPa

⚠Warning ： Do not use this system in the conditions other than those specified

2.2.4 Monitor Specification

2.2.4.1 Main Monitor

Voltage	12V
Dimension	19 inch，16：10
Resolution	1680×1050
Visible angle	≥170

2.2.4.2 Touch Screen

Voltage	12V
Dimension	10.4inch
Resolution	1024×768
Visible angle	≥170

3 System Installation

3.1 Preparations for Installation

NOTE:	Do not install the machine in the following locations: Locations near heat generators; Locations of high humidity; Locations with flammable gases.

3.1.1 Electrical Requirements

3.1.1.1 Requirement of Regulated Power Supply

Power specification is showing in 2.2.2.Due to the difference of the power supply stability of different districts, please advise the user to adopt a regulator of good quality and performance such as an on-line UPS.

3.1.1.2 Grounding Requirements

The power cable of the system is a three-wire cable, the protective grounding terminal of which is connected with the grounding phase of the power supply. Please ensure that the grounding protection of the power supply works normally.

⚠WARNING:	**DO NOT connect this system to outlets with the same circuit breakers and fuses that control the current of devices such as life-support systems. If this system malfunctions and generates an over current, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.**

3.1.1.3 EMI Limitation

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) by radio frequencies, magnetic fields, and transient in the air wiring. They also generate a weak electromagnetic radiation. Possible EMI sources should be identified before the unit is installed. Electrical and electronic equipment may produce EMI unintentionally as the result of defect.

These sources include: medical lasers, scanners, monitors, cauterizing guns and so on. Besides, other devices that may result in high frequency electromagnetic interference such as mobile phone, radio transceiver and wireless remote control toys are not allowed to be presented or used in the room. Turn off those devices to make sure the ultrasound system can work in a normal way.

3.1.2 Installation Conditions

3.1.2.1 Space Requirements

Place the system with necessary peripherals in a position that is convenient for operation:

1. Place the system in a room with good ventilation or an air conditioner.
2. The door is at least 0.8m wide. The ultrasound machines can move into the room easily.
3. Leave at least 20cm clearance around the system to ensure effective cooling.
4. A adjustable lighting system in the room (dim/bright) is recommended.
5. Except the receptacle dedicated for the ultrasound system, at least 3-4 spare receptacles on the wall are available for the other medical devices and peripheral devices.
6. Power outlet and place for any external peripheral are within 2 m of each other with peripheral within 1 m of the unit to connect cables.

3.1.2.2 Networking Pre-installation Requirements

Both wireless and wired LAN are supported by this ultrasound system.

Data transmission is allowed between different departments or areas without network cable. Network can be automatically connected after disconnection in case that the device is required to be moved, wireless transmission task can be recovered after the network resumed to normal condition. Confirm the network devices and network conditions before the installation.

1. General information: default gateway IP address, and the other routers related information.
2. DICOM application information: DICOM server name, DICOM port, channels, and IP address.

3.1.3 Confirmation before Installation

Perform the following confirmation before installing the system:

1. The video format used in the region or country where the system is installed.
2. The language used in the region or country where the system is installed.
3. The power voltage used in the region or country where the system is installed.
4. Obstetric formulae and other measurement formulae used in the region or country where the system is installed.
5. Other settings to be used in the region or country where the system is installed but different from the factory settings.
6. The doctor's habits of using the system.

Perform the confirmation above before installing the system. And set up the system to make it according with the usage of the region or country where the system is installed.

3.2 Unpacking

Tool: scissors

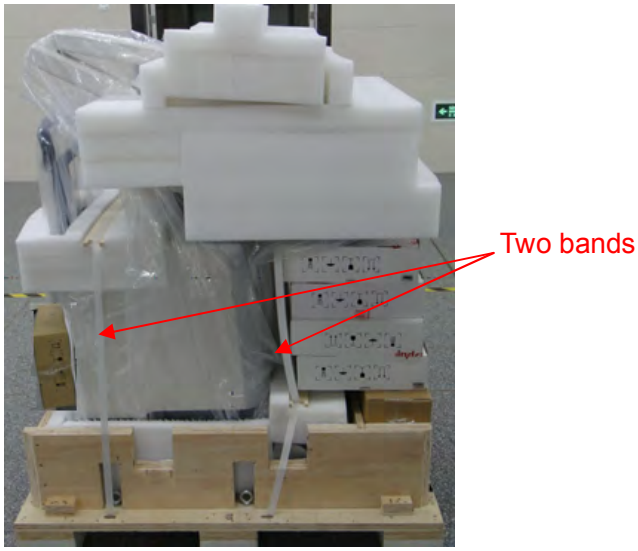
Installation duration: 2 person, 0.5 hour.

3.2.1 Unpacking

1. Cut the eight bands rounding the box, see the figure below:

2. Remove the top wooden cover, take away the paper box upward, lay down the slopping wood board, and stick the wood board with pallet together using velcro, see the figure below:

3. Take away the probe carrying case, accessories case and the protecting foams, then cut the bands rounding the machine, see the figure below:



4. Take out the frontal baffle-board.

5. Take the control panel handle to lift the machine slightly, remove the frontal baffle-board (two person), see the figure below:

6. Unlock the casters, hold the hand holder and lift up the machine (make the posterior casters landing on the ground), and then push down the machine carefully.

3.2.2 Notice of Packing

Please operate as follows when packing the machine again: As shown in the figure, dial the white fixing perch between two supporting arms, meanwhile, press the supporting arm down to the lowest position (about 45 degree from horizontal position) then do the related operation.

3.2.3 Checking

1. After unpacking, check the objects in the container with the package list to see if anything is in short supply or is wrong.
2. Inspect and make sure there is no damage to the machine, no indentation, no cracks.

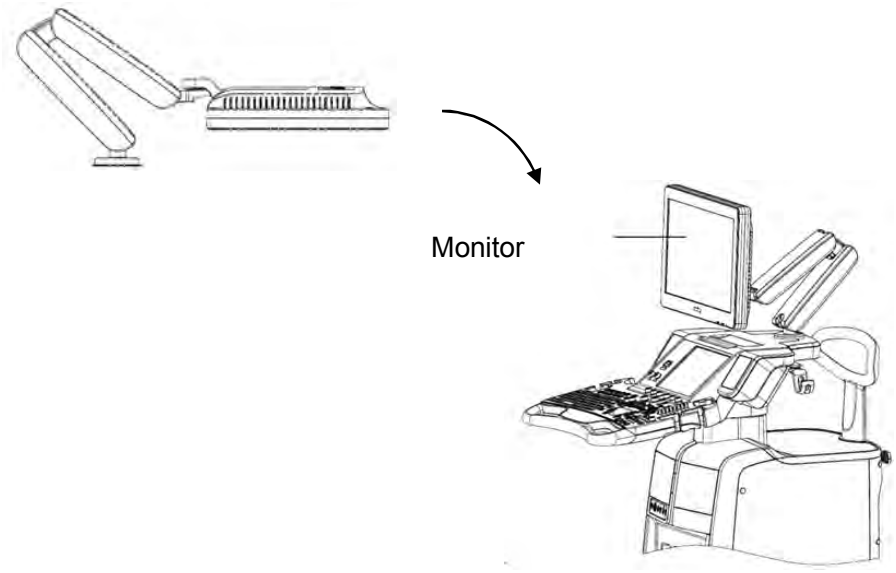
NOTE:	When install the machine, the customer Service engineer should check rising and lowering of machine. If the function is abnormal, follow the operations as shown in 7.5.

3.3 Installation of Main Unit

NOTE:	To prevent the machine from damage, when you perform the following operations, please lock the casters if the machine doesn't to be moved

3.3.1 Open up the Monitor

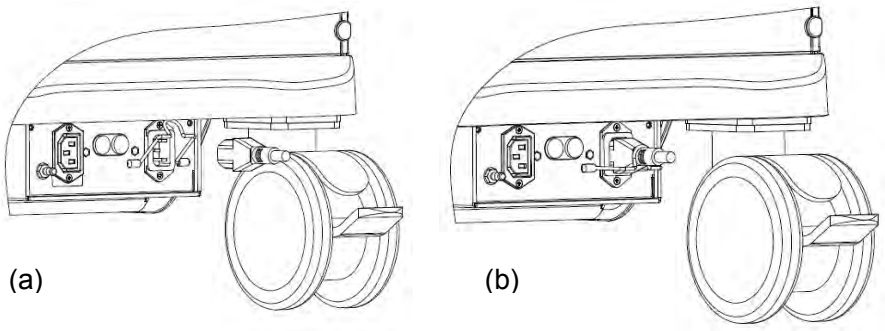
Adjust the monitor to the position as shown in the figure below.



NOTE:	Take care of your hands when adjust the monitor up and down.

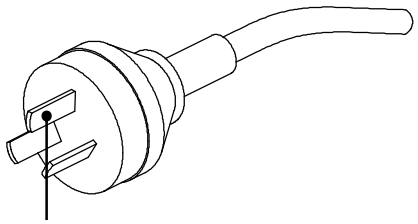
3.3.2 Connecting the Power Cord

1. Push the retaining clamp upward, and insert the power plug into the receptacle, as shown in the figure (a) below.



(a) (b)

2. Push the retaining clamp downward, and lock the power cord, as shown in the figure (b) above.
3. Plug the other end power plug into an appropriate outlet. The grounding terminal should be connected with a power grounding cable to ensure that protective grounding works normally.



Grounding terminal

NOTE:	Make sure to allow sufficient slack in the cable so that the plug is not pulled out of the wall if the system is moved slightly.

3.3.3 Connecting ECG

Connect the ECG cable to the corresponding interface on the physio panel.

3.3.4 Install Endocavity probe bracket

Fix the endocavity probe bracket with two M4X12 screws as follow:

Endocavity probe bracket

M4X12 screws (2 pcs)

3.3.5 Connecting the Transducer

Four sockets (A, B, C, D) are configured on the system; Every socket can be connected with all types of supported transducers.

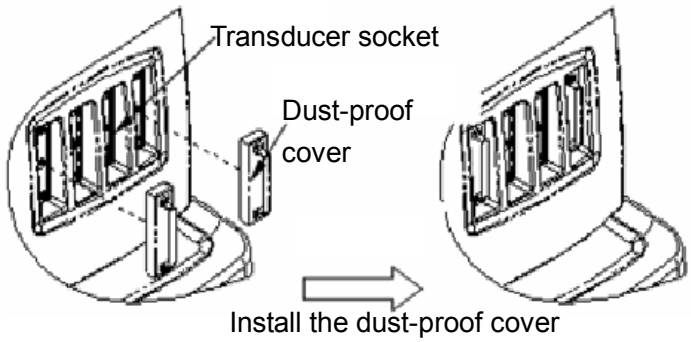
1. Keep the cable end of the transducer to the right side of the system, and insert the connector into the socket of the system, and then press in fully. (Shown as the left figure)
2. Turn the lock handle 90° clockwise to lock it securely. (Shown as the right figure)

3. Place the probe properly to avoid being treaded or wrapping with other devices. DO NOT allow the probe head to hang free.
4. Turn the lock handle 90°anticlockwise to unlock it, and then pull out the connector.

NOTE:	Before inserting the connector into the probe port, inspect the connector pins. If any pin is bent, do not use the probe until it has been inspected / repaired / replaced.

3.3.5.1 Using the Probe Dust-proof Cover

If a probe port is not used for a long period of time, please use the dustproof cover to protect the probe port from dust; otherwise bad contact may result.

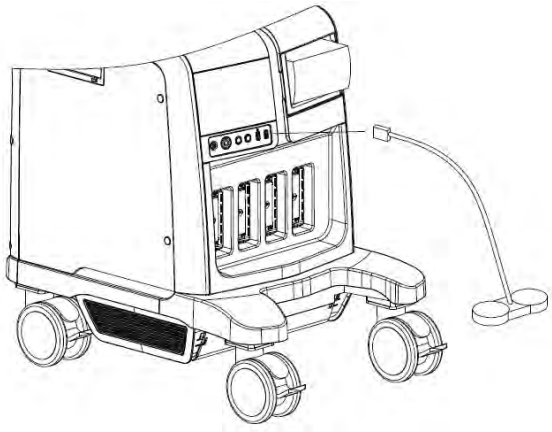


3.4 Installing Peripherals

For the models of the supported peripherals, please refer to “2.1.3 Supported Peripherals”.

3.4.1 Connecting the Footswitch

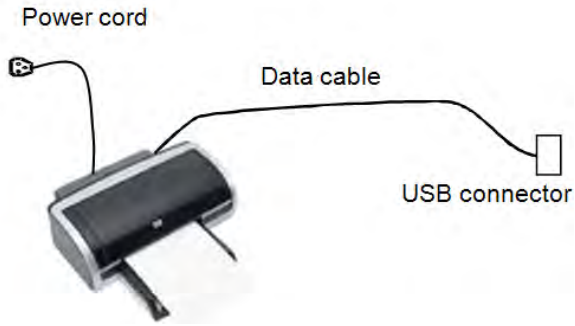
1. Directly insert the USB plug of the footswitch to the system applicable USB ports.



2. Function setting: for details, please refer to “3.5.3 System Preset”.

3.4.2 Installing a Graph / Laser Printer

The graph / laser printer is connected to the system via the USB port on system. As shown in the figure below, a graph / laser printer has a power cord and a data cable.



1. Connect the data cable with the USB port on the system.
2. Connect the power cord to an appropriate power supply.
3. Printers listed in this manual (referring to 2.1.3) have drivers installed already.

3.4.3 Installing Video Printer

The system support both black/white video printers (analog and digital) and color video printers (analog and digital).

⚠CAUTION: The auxiliary power outlet in the system is used to supply power for approved peripheral devices. Do not connect other/unapproved devices to this outlet; otherwise the rated output power may be exceeded and the system failure may result. Maximum output power of the outlet is 240VA.

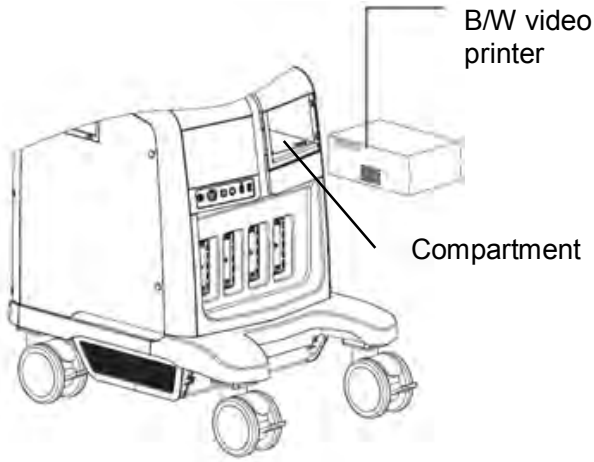
3.4.3.1 Analog Video Printer

- **B/W Analog Video Printer**

Take UP-897MD for example.

1. Plug the AC power cord hidden in the compartment under the control panel of the system to the AC LINE port of the printer.
2. Connect the video signal cable in the compartment to the VIDEO IN port on the printer, and connect the Remote control cable to the Remote port on the printer.
3. Place the printer inside the compartment. Place another printer, if available, on the platform behind the control panel.

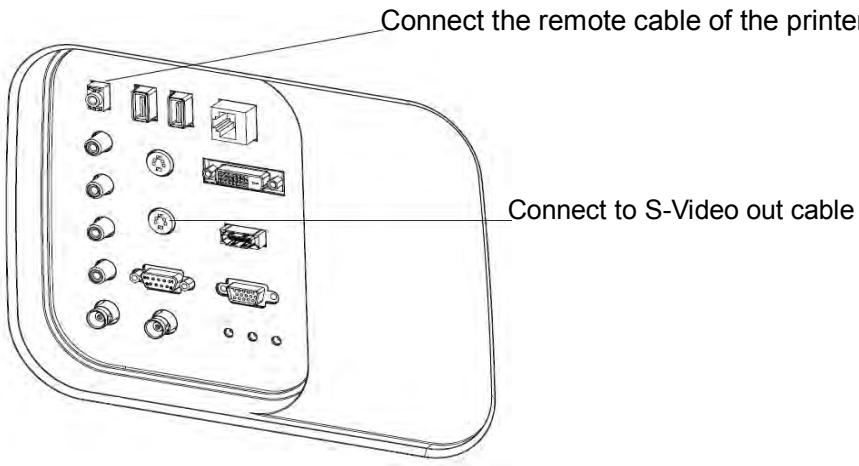
Note: Analog video printers do not need to install drivers. Other analog video printer's installation procedures are the same as those of UP-897MD.

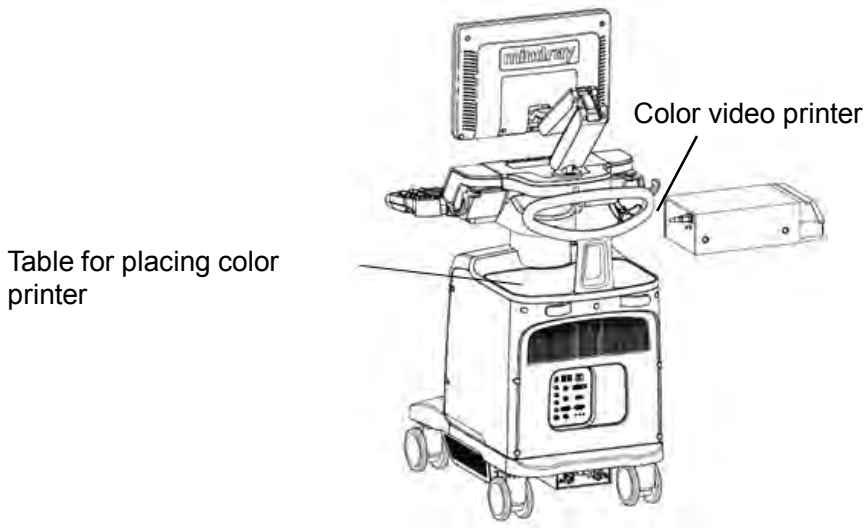


Installing a B/W Video Printer

◆ **Color Analog Video Printer**

Connect the power cable to an appropriate power supply. Other cables are as follows:





Installing a color video printer

3.4.3.2 Digital Video Printer

The installation method of B/W digital Video Printer is similar to color digital Video Printer. Take MITSUBISHI P93DC for example.

1. Place the printer inside the compartment. Place another printer, if available, on the platform behind the control panel.
2. Plug the AC power cord hidden in the compartment under the control panel of the system to the AC LINE port of the printer.
3. Connect the USB video cable in the compartment to the port on the printer.
4. Printers listed in this manual (referring to 2.1.3) have drivers installed already.

3.4.3.3 Wireless Printer

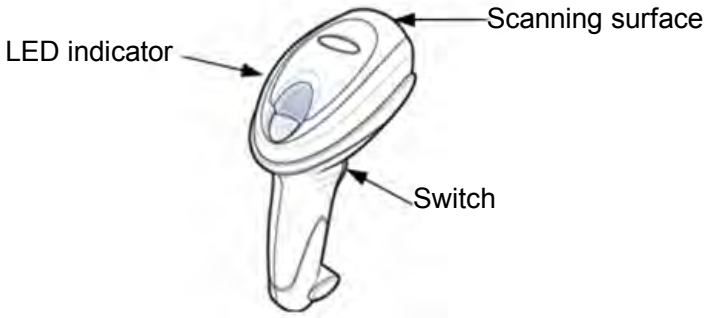
HP e-All-IN-ONE B210a is a wireless printer used for report printing (not supported by Doppler system V4.0 and later version).

1. Plug the printer power cord to an appropriate outlet.
2. Power on the system and the printer.
3. Make sure the ultrasound machine and the printer are connected to a same LAN, and turned on the W-LAN function of the printer.
4. Open the [Preset]→[Printer Preset] page, select “Report Print” in the printer list, and then select the printer to be HP e-All-IN-ONE B210a, and set properties.
5. Click [OK] to exit the preset and make the settings effective.

3.4.4 Installing Barcode Scanner

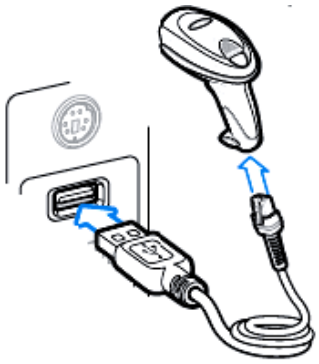
The system supports barcode reader to read the patient information (ID).

1. For structure of the scanner, see the figure below. The important parts are: LED indicator, scanning surface, and the switch.



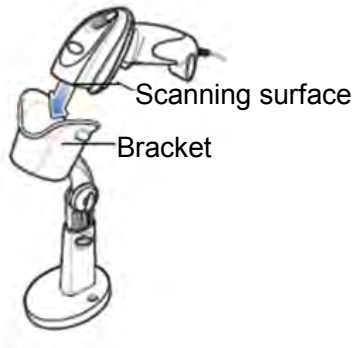
2. Connect the cable to the port on the scanner.

3. Connect the other end of the cable to the USB port on the ultrasound system.



4. When the ultrasound system is working, information scanning can be performed by pressing the switch on the scanner. For detailed operations, please refer to the operator's manual of the scanner.

5. Fix the scanner on the bracket (see the figure below) to avoid accidental falling.



2D scanner

1D scanner

1D scanner

3.5 System Configuration

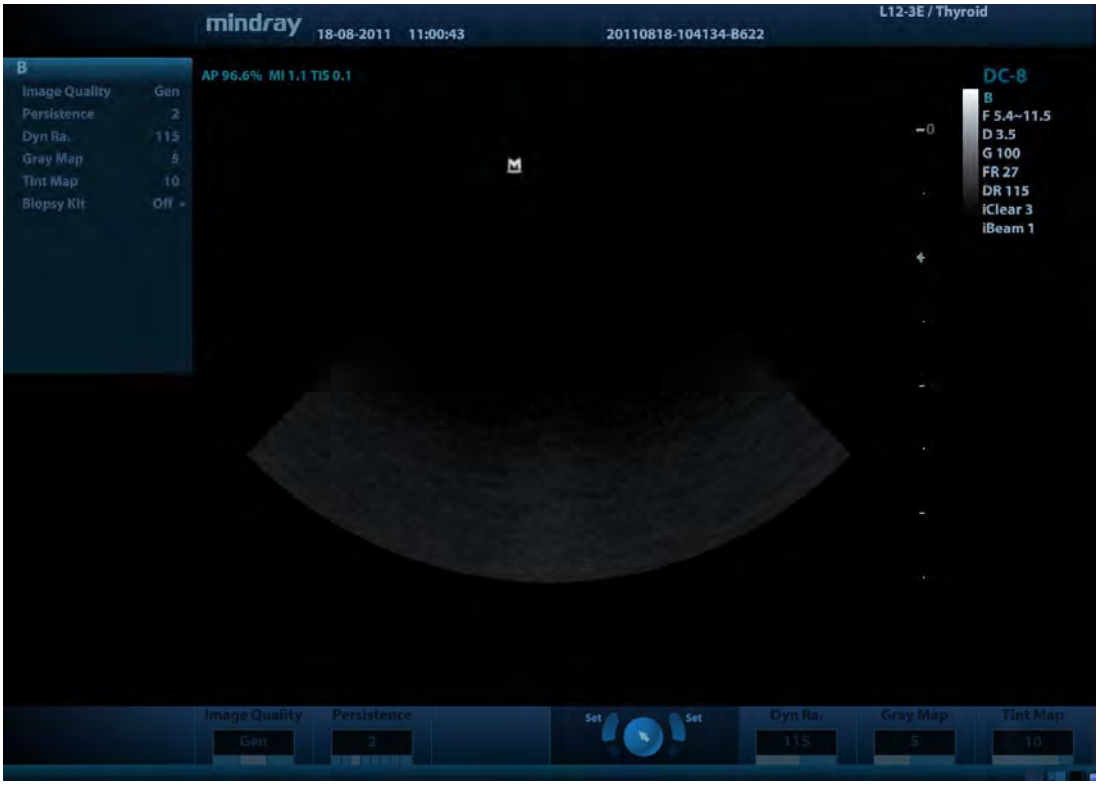
3.5.1 Running the System

Connect the AC power; make sure the ultrasound system and other optional devices are correctly connected.

The circuit breaker should be in the [Up] position for the system to be operational. When the AC power indicator on the control panel is light on (indicator ~ is in green), press the power button ⊙/○ on the minor control panel to turn on the system.

3.5.2 Enter into DOPPLER

After system is turned on and wait for about 1 minute (for system initialization), it will enter into Doppler interface, see the figure below:



3.5.3 System Preset

1. Press <F10> on the keyboard to open the Setup menu.

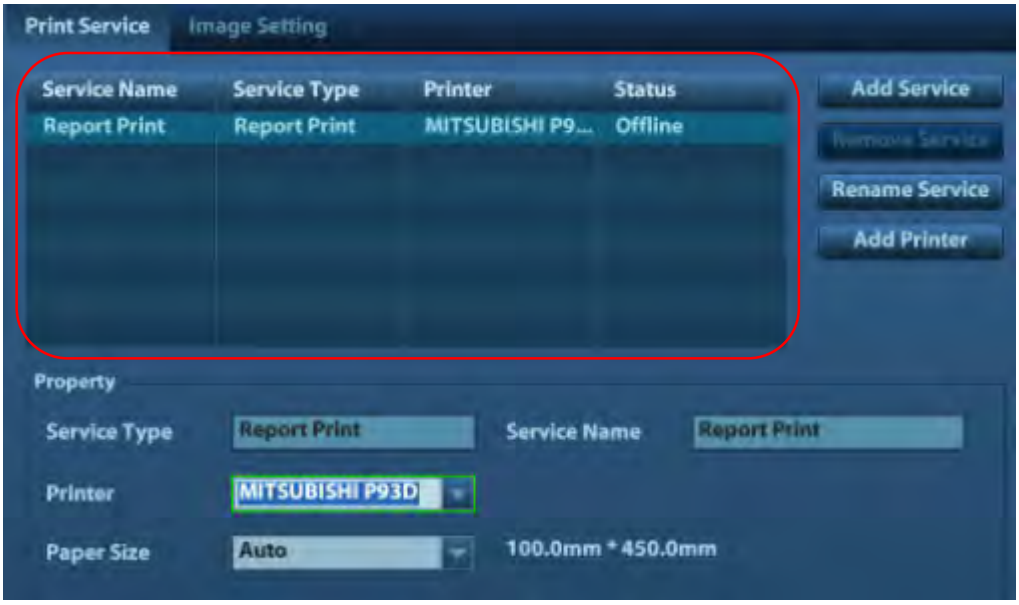
2. Click [System Preset] to open the System Preset screen.

The following settings can be performed on the System Preset screen.

No.	Item
1.	Region: preset the hospital name, date and time, and select the language.
2.	Key Config: preset the function of user defined keys (F3～F6, F12, P1, P2) and the footswitch, key lightness, key volume and trackball speed can be adjusted.
3.	General: preset the time in standby mode, set the brightness/contrast of the display.

3.5.4 Print Preset

1. Press <F10> and click [Print Preset] to set video printer, graph/laser printer parameters (do the setting according to the printer, and select the printer services correspondingly).



2. The printer related information will be displayed automatically, if additional printer is needed, click [Add Printer] to do the setting. Click [Next] on the Add Printer Wizard screen to open the following screen.

Add Printer Wizard
Local or Network Printer
The wizard needs to know which type of printer to set up.
Select the option that describes the printer you want to use:
Local printer attached to this computer
Automatically detect and install my Plug and Play printer
A network printer, or a printer attached to another computer
To set up a network printer that is not attached to a print server, use the "Local printer" option.
< Back
Next >
Cancel

➢ Add Local printer

a) Select “Local printer attached to this computer”, then click [Next], the system will detect the printer connected with the ultrasound machine.

b) If no printer has been detected, then manual installation should be performed.

Note: in the printer driver installation procedure, use the right <Set> key to operate.

When you install the printer’s driver, you must specify the specific path for installation; otherwise, vague path may result in longer time for searching.

NOTE:	1. Before adding the local printer, make sure the printer is powered on, and the printer has been correctly connected with the ultrasound system(sound feedback will be heard during the connection)

2. In case of installation failure in Doppler, try to install the printer in Windows (click [Enter Windows] on the Maintenance menu). If the installation can't be performed neither in Doppler nor Windows, then the printer can't be supported by the ultrasound system.
3. Use the original drive disk to perform the drive installation.

➢ Add network printer

Select "A network printer, or a printer attached to another computer "; click [next] to add the network printer.

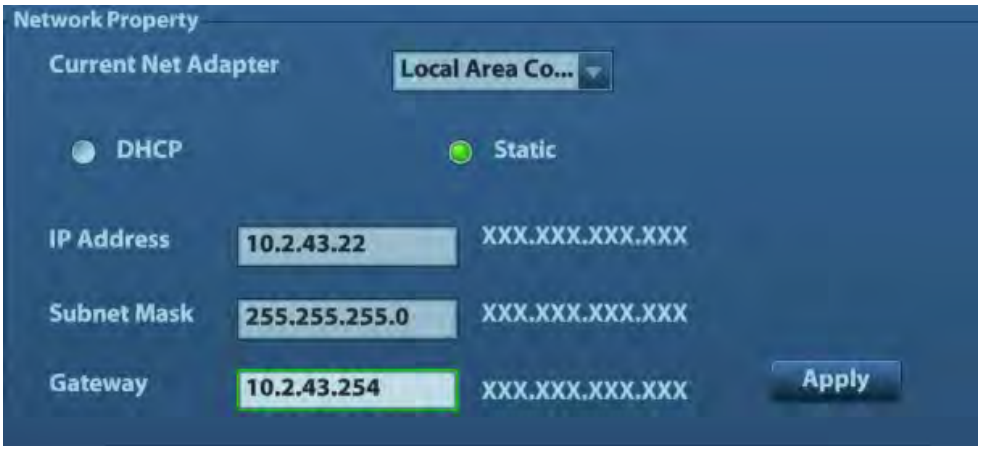
NOTE:

1. Before connect the network printer, make sure the ultrasound system and the printer are in the same network domain, and the network is working normally.
2. When add a network shared printer, if the server has set accessing limitation, the system will prompt a dialogue box to identify the user. Enter the correct user name and password, click [Auto Connect], and then click [OK].
3. Make sure to enter a valid printer name, e.g., \\server\printer, **otherwise** the connection may be fail.

3. After successful connection, the printer name will be listed out on the Printer list.

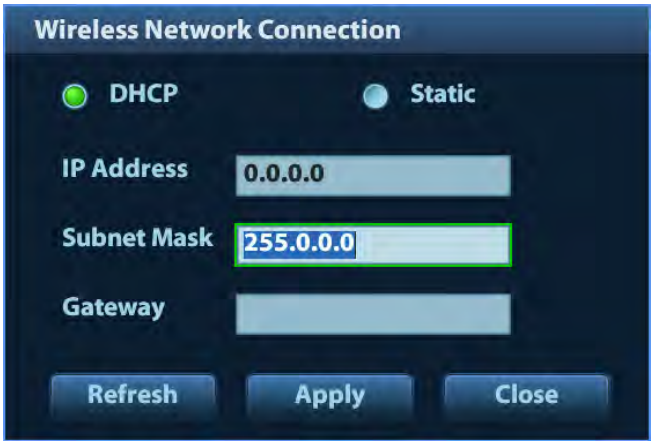
3.5.5 Network Preset

In Doppler version earlier than 04.00.00, open "[Setup]→[Network Preset]→[Local TCP/IP Setting]" to enter the following screen.



In Doppler 04.00.00 and later version, click the network icon on the system tool bar at the right lower coner, to enter the following screen.

a) Click [IP Config] to enter the following dialog box:



b) Select “DHCP”, and then click [Apply].

c) Or, select "Static", input the IP address, subnet mask and gateway, then click [Apply].

NOTE:	IP address of the system should be at the same network segment as that of the server.

3.5.6 DICOM Preset

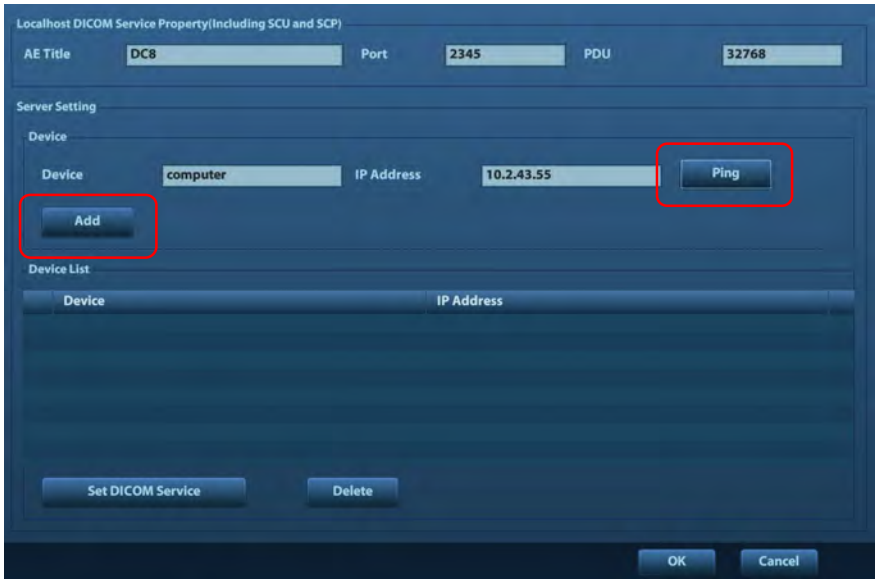
NOTE:	Only if DICOM basic option is configured, [DICOM Preset] is available.

1. Click [DICOM Preset] to open the DICOM Preset screen. Enter the AE Title of the ultrasound system, port and PDU according to the actual situation.
2. DICOM Server Setting
   1) Enter the device name and the IP address.
   2) You can ping other machines to verify connection after entering the correct IP address by

clicking [Ping].

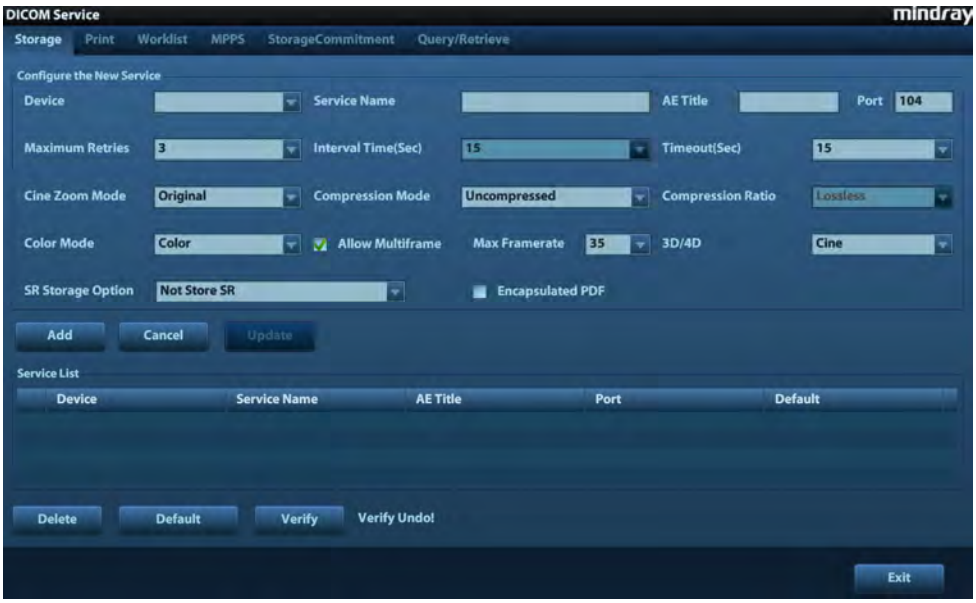
3) Click [Add] to add the server to the list if the connection works normally.

The following is an example:



NOTE:	1.	AE Title should be the same with the SCU AE Title preset in the server (PACS/RIS/HIS).
	2.	DICOM communication port should be the same with the one in the server.
	3.	If the currently entered name has already existed, the system will pop up: "The server name exists!" Click [OK] to enter another name.

3. Click [DICOM Service].



When the system is configured with DICOM basic function module, and installed DICOM Worklist, MPPS, DICOM Structured Reporting and Query/ Retrieve modules, the corresponding preset settings can be found in DICOM Service screen.

The DICOM Service Setting is used to set properties of DICOM services as Storage, Print, Worklist, MPPS, Storage Commitment and Query/ Retrieve. The detailed information please refer to “DICOM” of user manual.

NOTE:	Only if DICOM basic option is configured, Worklist page is available.

3.5.7 Check System Information

In System Information screen, it displays the product configuration, the optional installation status, software version, hardware & boards, and driver related information. You can check the product information here.

1. Press <Setup>, and then click [System Info] to open the following screen.

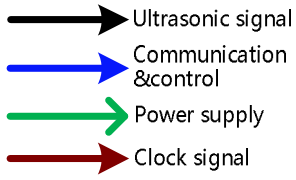
2. On About Detail page, system hardware & board related information can be seen.
3. Confirm the system information is correct, and then export the system information in a file of .txt format.

NOTE:	1. Be sure to confirm the system information before and after the software maintenance. 2. If necessary, please ask the user to save the current system information.

4 Product Principle

4.1 General Structure of Hardware System

◆ **Symbols illustration**



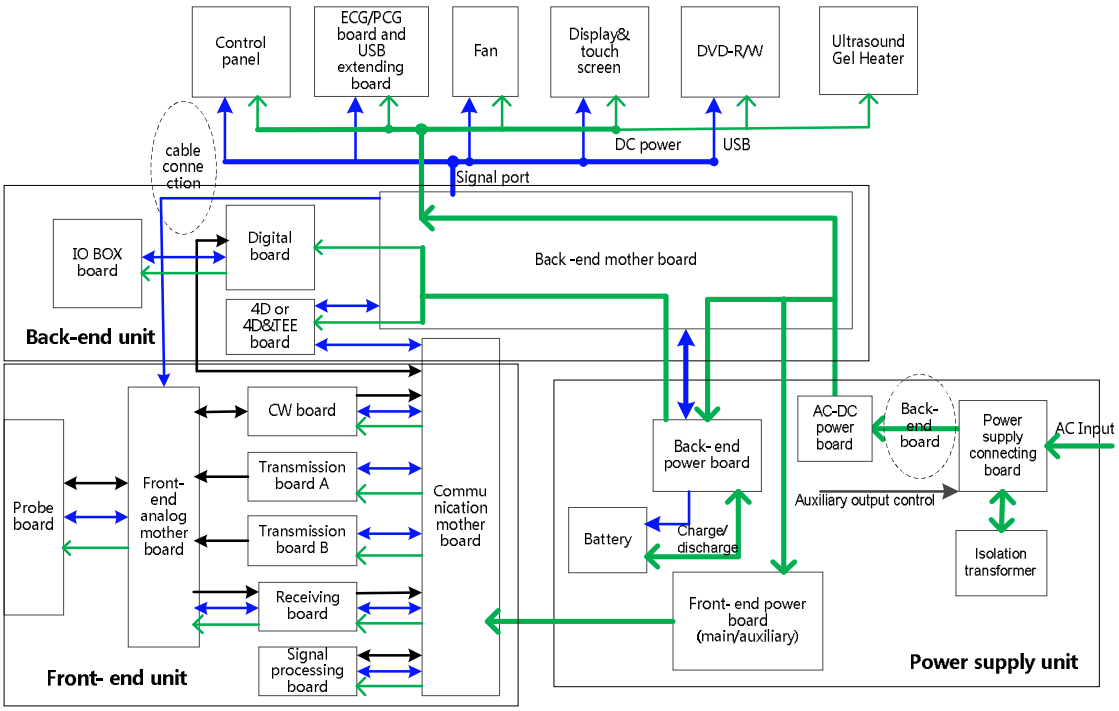


Figure 4-1 Schematic Diagram of System Hardware

As described in the figure above, the hardware consists of the following units:

- Front-end unit (probe board, CW board, transmission board A, transmission board B, receiving board, Signal processing (DSP) board, front-end analog motherboard, communication motherboard)
- Back end unit (digital board, 4D or 4D&TEE board, IOBOX board, back end motherboard);
- Control panel unit;
- Main display unit;
- Touch screen unit;
- ECG/PCG board;

- Power supply unit (front-end power board, back -end power board, AC/DC power board).

4.2 Ultrasound Front-end Unit

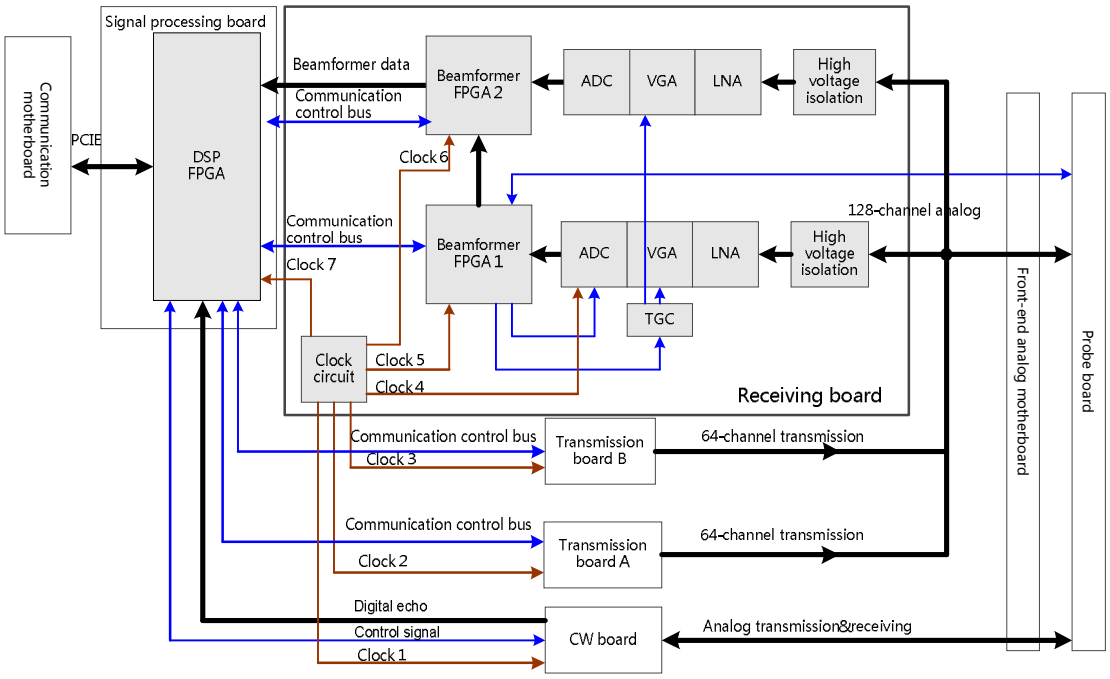


Fig 4-2 Schematic diagram of ultrasound front-end unit

Front-end unit mainly consists of:

- Probe board
- CW board;
- Transmission board A and transmission board B;
- Receiving board
- DSP board (Signal processing board for short ,supporting 4D and elastography);

To separate the analog area from the digital area properly, front-end analog motherboard (mainly contains front-end analog signal channel) and communication motherboard (mainly contains digital signal and power channel) are added to the system. Front-end receiving unit carries out 128-channel transmitting and receiving. The ultrasound image signal will be sent to the CPU module on the digital board for post processing after amplification, A/D conversion, beam forming and signal processing.

For details of the boards, see the following chapters:

4.2.1Probe Board

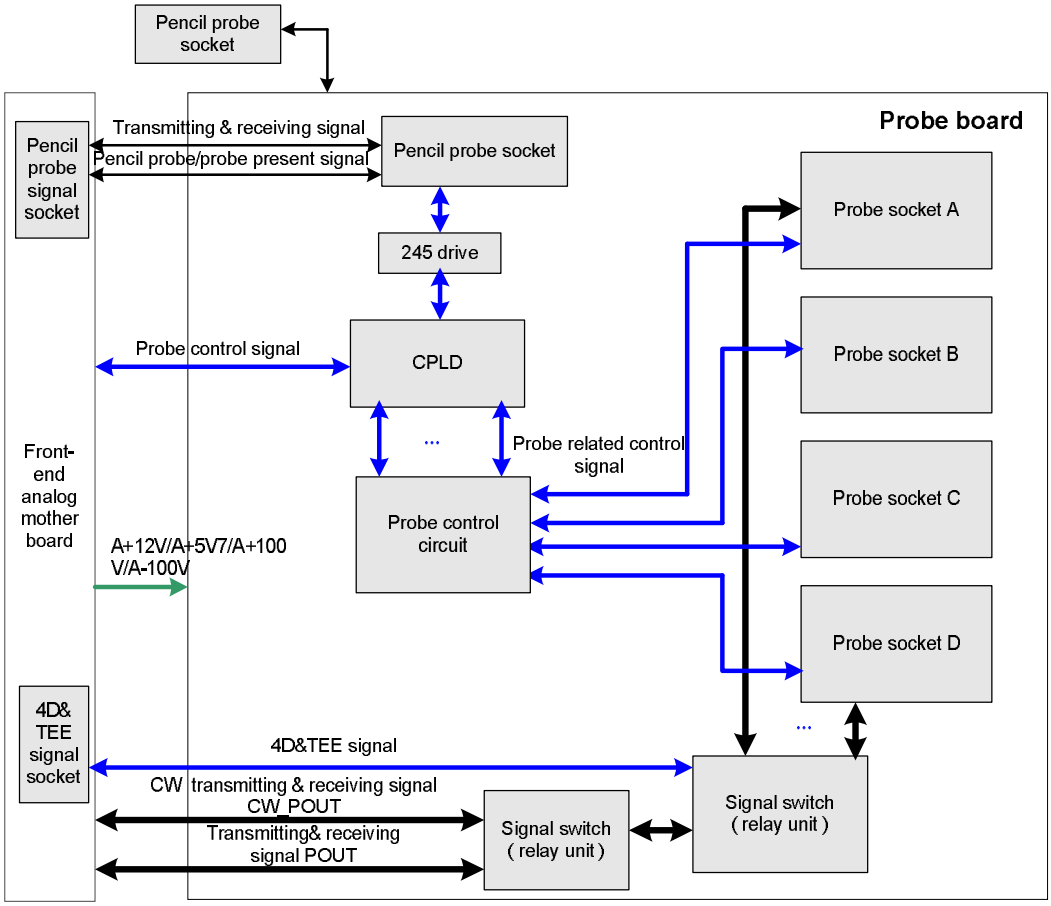


Fig 4-3 Schematic diagram of probe board

Hardware structure of the probe board is shown as the figure above:

Functions of the probe board are:

- Supports 256/192/128elements probes, 4D probes, 128/96/64-elements phased array probes and TEE probes;
- Probe board only supports 128 channels; for 192/256elements probe, elements switching is performed in the probe to match 128 channels on board. Including four 260-pin probe sockets.
- Supports 4 probe ports switching and ID recognition of probes on every port. The circuits for ID recognition and probe switching are independent.
- Supports echo signal channel switching, outputting CW signal independently which can improve CW signal-noise ratio.

4.2.2 CW Board

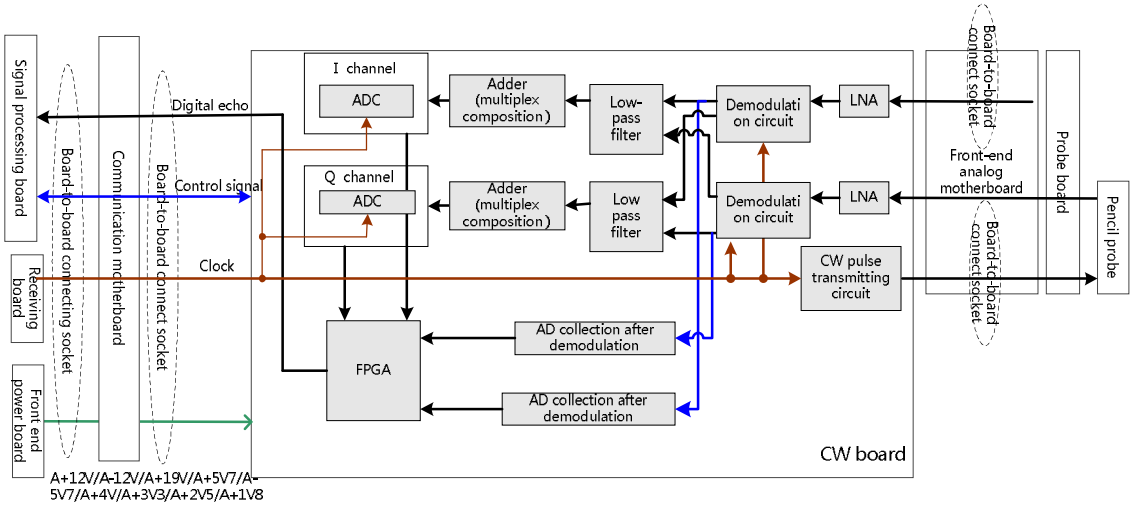


Fig 4-4 Schematic Diagram of CW Board

Function (Only phased array probe and pencil probe are supported):

- Realizing transmitting, receiving and beam forming of CW signal;
- Parameter control and mode switching in CW mode;
- Data output by beam former are output to DSP board, and then upload to CPU module for CW image processing via the upload logic chip.
- The system can communicate with the CW board via the communication control bus.

4.2.3 Transmission Board

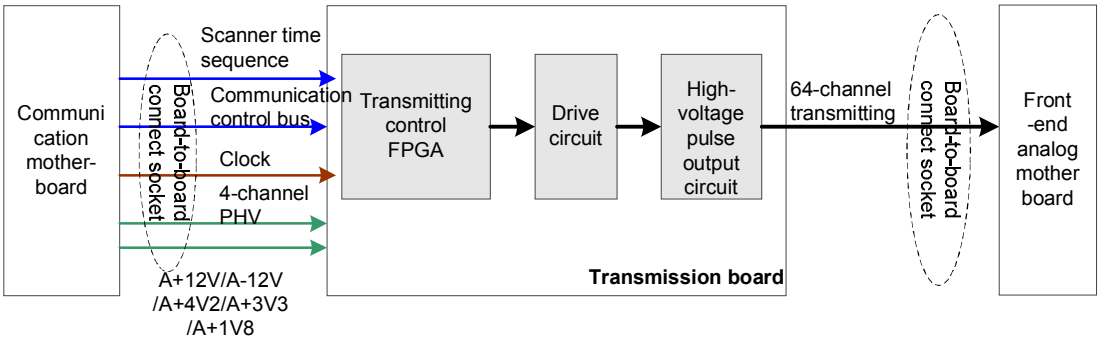


Fig 4-5 Schematic Diagram of Transmission Board

Hardware structure of the transmission board is shown as the figure above. Realize 128-channel transmission pulse. For 192/256-elemented probe, the high voltage switching is realized in the housing of the probe. There are two transmission boards: board A and board B, each board takes charge of 64-channel transmission pulse. Board A and board B are the same, so both of them are named transmission board. Only difference is the position.

Function:

- Generate 64-channel transmission waveform according to the scanning sequence and control parameter.
- The 64-channel transmission waveforms are drove into 64-channel high-voltage transmission pulses by the drive circuit.

- The system can communicate with the transmission board via the communication control bus.

4.2.4 Receiving Board

The main structure of the receiving board is shown as the figure below, which consists of high-voltage isolation, ultrasonic receiving, beam former, etc.

Function:

- High-voltage isolation;
- LNA, VCA/PGA, LPF, ADC, which are performed by the integrated front-end chip;

ATGC module, voltage gain control module;

- Beam former, performed by FPGA;
- Clock module, the clock source of the whole front-end unit is on the receiving board, clock buffer is sent to the corresponding board via communication mother board.
- Power module, receiving the power from the communication mother board and transferring it into power required by receiving board
- Configuration module, configure the FPGA on the board.

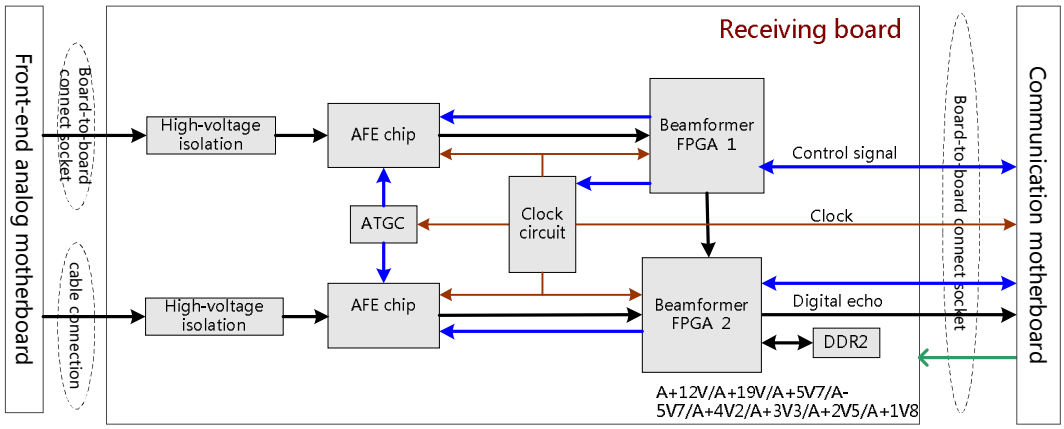


Fig 4-6 Schematic Diagram of Receiving Board

4.2.5 Signal Processing Board

The signal processing board can be divided into two kinds: one kind can support 4D and elastography, while the other one doesn't support 4D and elastography. When 4D/TEE board is selected, the corresponding signal process board should be used.

The hardware structures of the two boards are shown as follows:

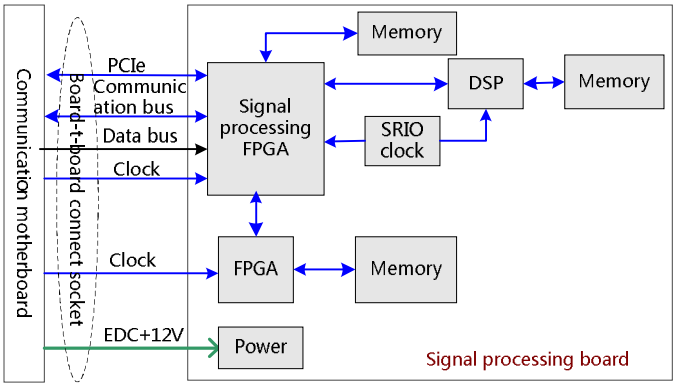


Fig 4-7 Schematic Diagram of Signal process board (support 4D and elastography)

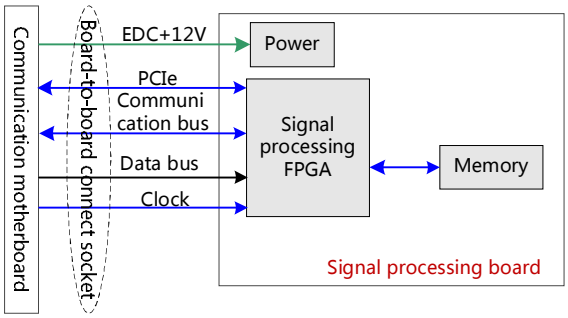


Fig 4-8 Schematic Diagram of Signal process board (not support 4D and elastography)

Function description:

- Digital signal process in B, C, D imaging modes.
- The imaging data will be packed and then uploaded to digital board CPU module for post processing.
- DSP chip is designed for elastography data processing, optional function.
- A FPGA is designed for New Color etc. Signal processing, reserved function.

4.2.6 Front-end Analog Mother Board

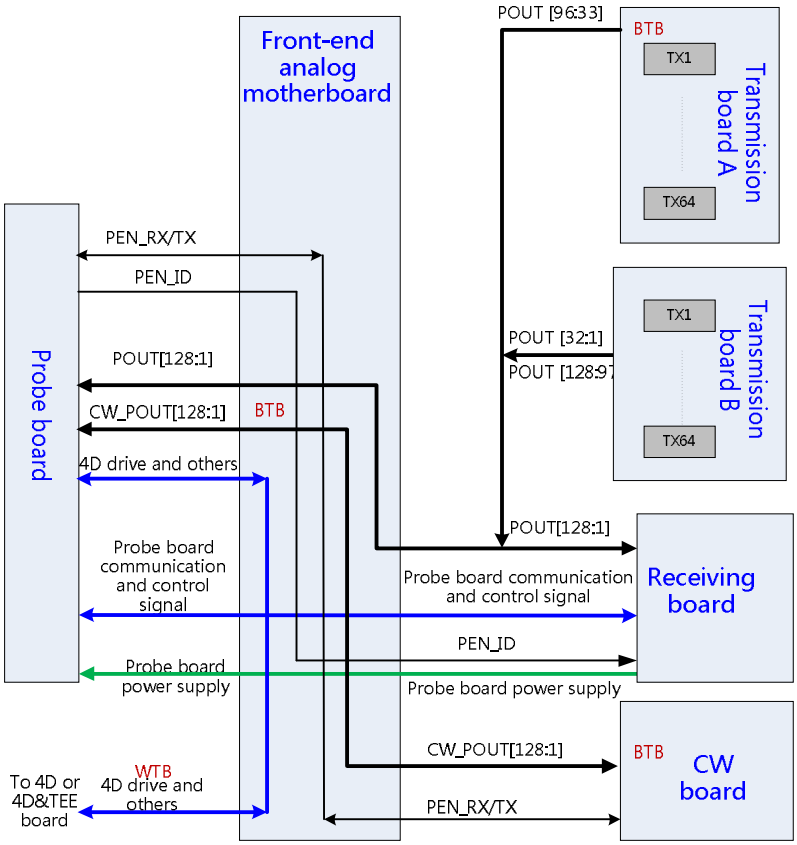


Fig 4-9 Schematic Diagram of Front-end Analog Mother Board

Function description:

- Signal transmission between probe board and other front-end boards.
- Analog signal transmission of front-end boards.

4.2.7 Communication Mother Board

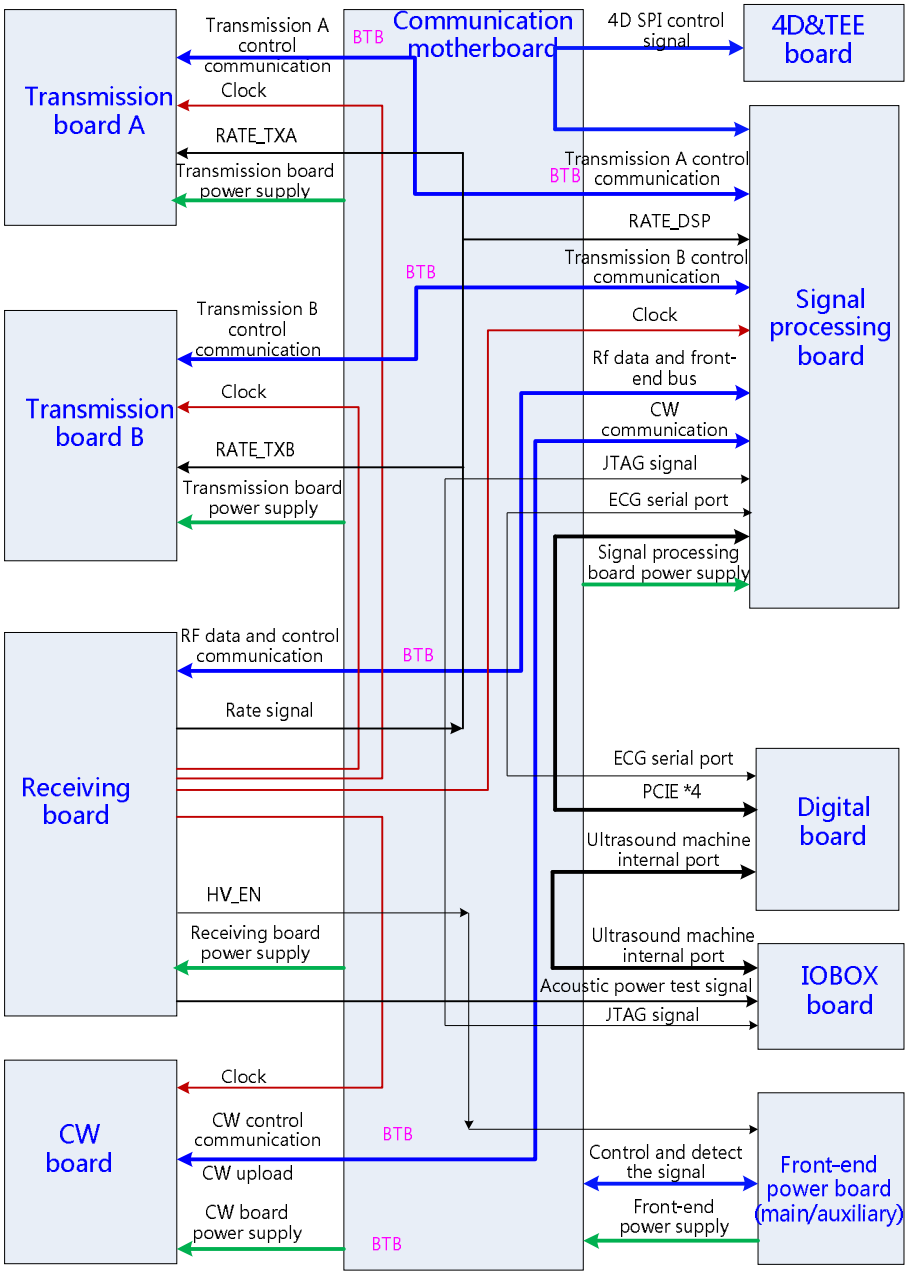


Fig 4-10 Schematic Diagram of Communication Mother Board

Main functions of the communication motherboard are:

- Digital signal transmission of the front-end boards;
- Control parameters transmission of the front-end boards;
- Power supply signal transmission of the front-end boards.

4.3 Ultrasound Back-end Unit

The back-end unit mainly consists of: digital board, back-end motherboard, IOBOX board, 4D, etc. See the figure below:

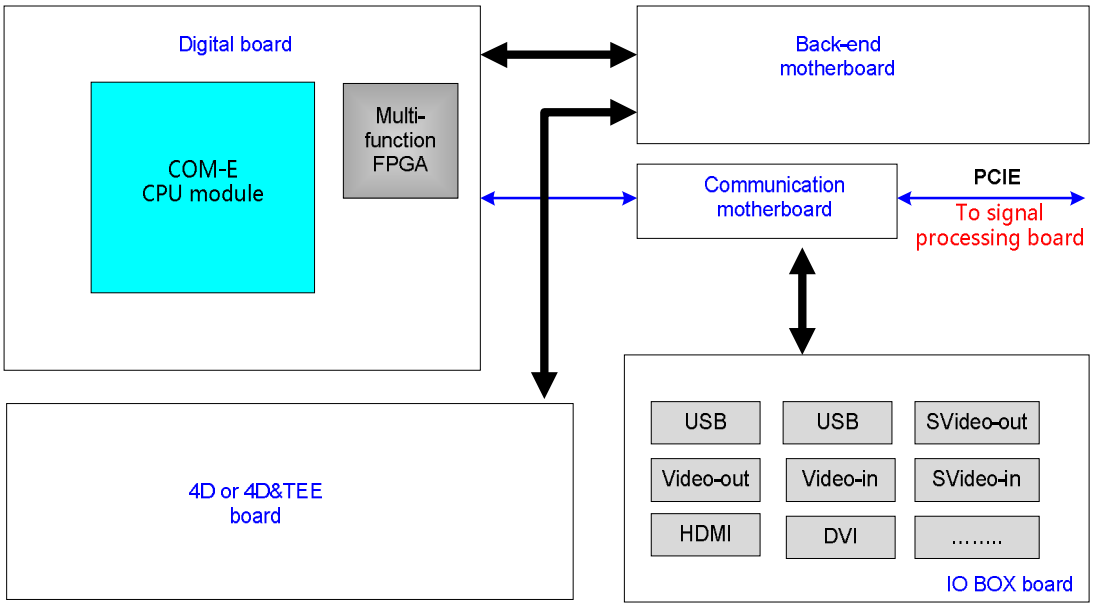


Fig 4-11 Schematic Diagram of Back-end Unit

4.3.1 Digital Board

The block diagram of the digital board is shown as below:

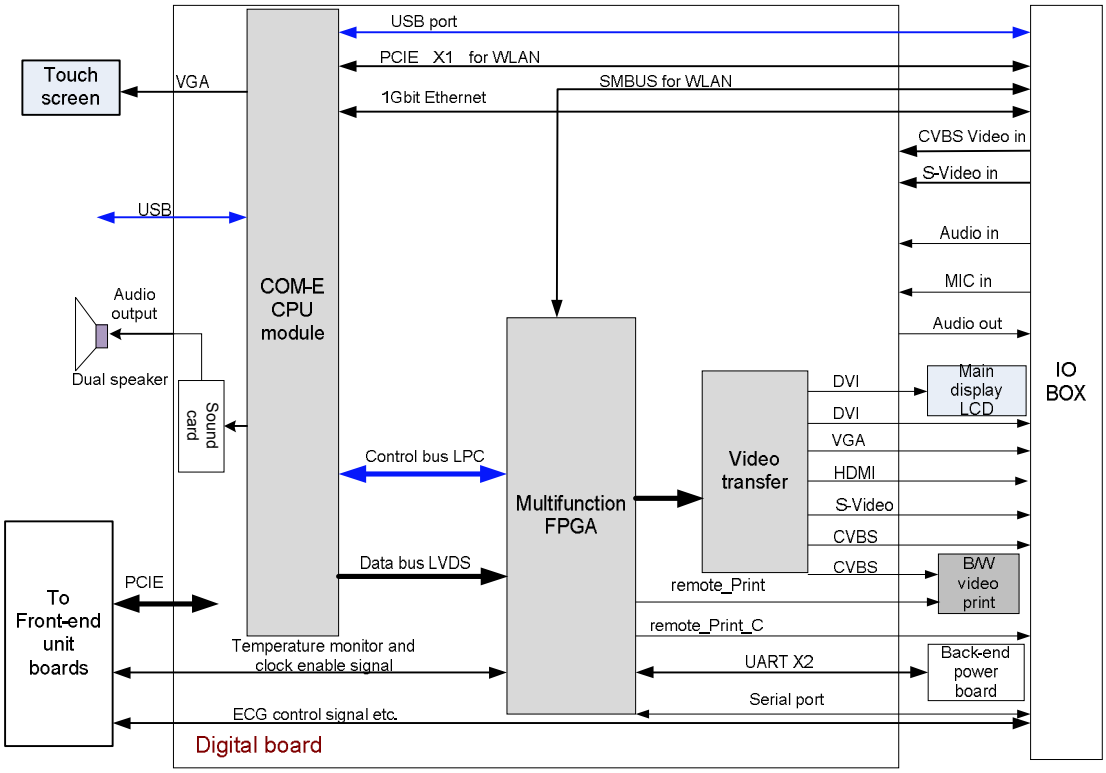


Fig 4-12 Schematic diagram of the digital board

Main functions of the digital board are:

- Standard COM-E socket;
- Back-end video processing, realize CPU module video output extending.
    a) DVI, 2 channels, used for main monitor and IOBOX board external display port, the resolution should support 1680×1050@60Hz
    b) VGA, 2 channels, one channel is used for external VGA port display extending, resolution 1680×1050@60Hz. The other channel is used for touch screen display, the resolution should support 1024×768@60Hz.
    c) Composite Video, 1 input, 2 outputs, used for external video output and internal B/W video printer, support PAL/NTSC switching.
    d) S-Video, 1 input, 1 outputs, support PAL/NTSC switching.
    e) HDMI port, 1 channel, not support audio, the resolution are the same as that of the main monitor.
- Audio processing
    a) Audio 1 input, 1 output, left and right stereo
    b) Power amplify output, the maximum single channel power is 12W, left and right stereo
    c) Support external MIC input.
- Port support
    a) G-bit Ethernet port, 1
    b) WiFi port
    c) Support footswitch, USB port
    d) Video print control port, 2, for both B/W and color
    e) SATA port, 2, DVD and HDD
    f) USB port, 10 channels, of which, 6 for external (2 at the front side, 2 at the lateral side and 2 at the backside), 4 for internal (connect the touch screen, keyboard, audio/video collection, digital video compress)
- Communication bus
    a) PCIE×4, 1channel, front-end data and control communication port.
    b) PCIE×1, 1 channel, WiFi module support
    c) UART, 4 channel, 2 power modules, 1 external serial port, 1 DVR control port (reserved), the external serial port is transferred by USB, other serial ports will be transferred by LPC bus through multifunction.
    d) SMBUS, 1 channel, reserved for WiFi module
    e) LPC, used for multifunctional communication control and transfer extending for part of the serial ports.

Besides, there is a multifunctional FPGA on the digital board for multifunction controlling, the FPGA takes charge of video format conversion, back-end control, port extending, etc. It mainly includes:

- Display extending:

Convert LVDS signal to all other video formats required by video output port chips, time sequence conversion, vide cutting and filling.

- Digital video port.

Supports digital video compress and storage, and the related control.

- Back-end communication and control

Extend serial port, used for battery management, high-voltage controlled SCM communication, etc. The functions are realized by the multifunctional FPGA using LPC bus.

Video print control, support video printer connecting.

Support I2C port, used for monitor status obtaining, parameter writing, etc.

4.3.2 DVR Board

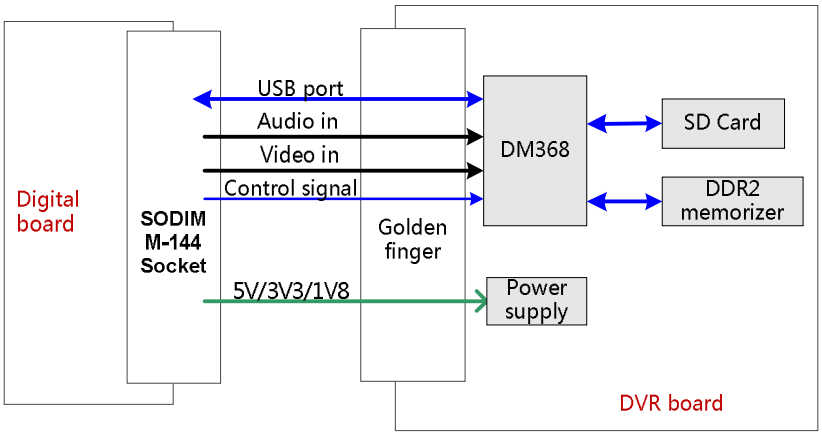


Fig 4-13 Schematic Diagram of DVR Board

Function description:

- Support video compress and storage.
  Only supports digital video, the resolution is 1680×1050@60Hz.
  The analog video compressing and storage function is reserved.
- Support audio compress and storage
- Video files can be output to the USB port and DVD-R/W.

4.3.3 IO BOX Board

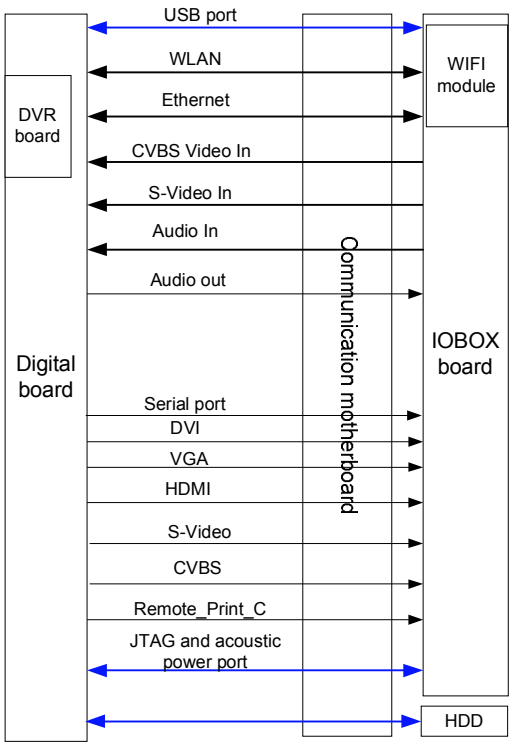


Fig 4-14 Schematic Diagram of I/O Box Board

Function description:

IOBOX board is used for output and input for the peripherals, the main ports including:

- DVI port
- VGA port
- HDMI port
- Video input
- Video output
- S-Video input
- S-Video output
- Audio input
- Audio output
- USB port, 2
- Ethernet port

Note: if not specified, the number of the above ports is 1.

For the convenience of system test and debugging, the following ports are designed on the IOBOX board:

- JTAG port of the FPGA
- JTAG port of the DSP
- Acoustic power test port

4.3.4 4D or 4D&TEE board

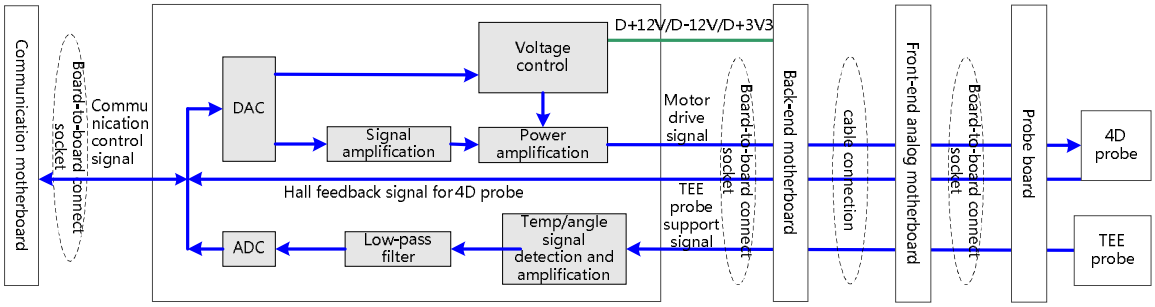


Fig 4-15 Principle Block Diagram of 4D or 4D&TEE board

Function description:

- Power amplification for 4D drive signal; output required signal to drive the probe to the designated position
- Provide 4D Hall signal returning channel.
- Amplify and collect the TEE probe temperature and angle signal.

4.3.5 Back-end Motherboard Connection

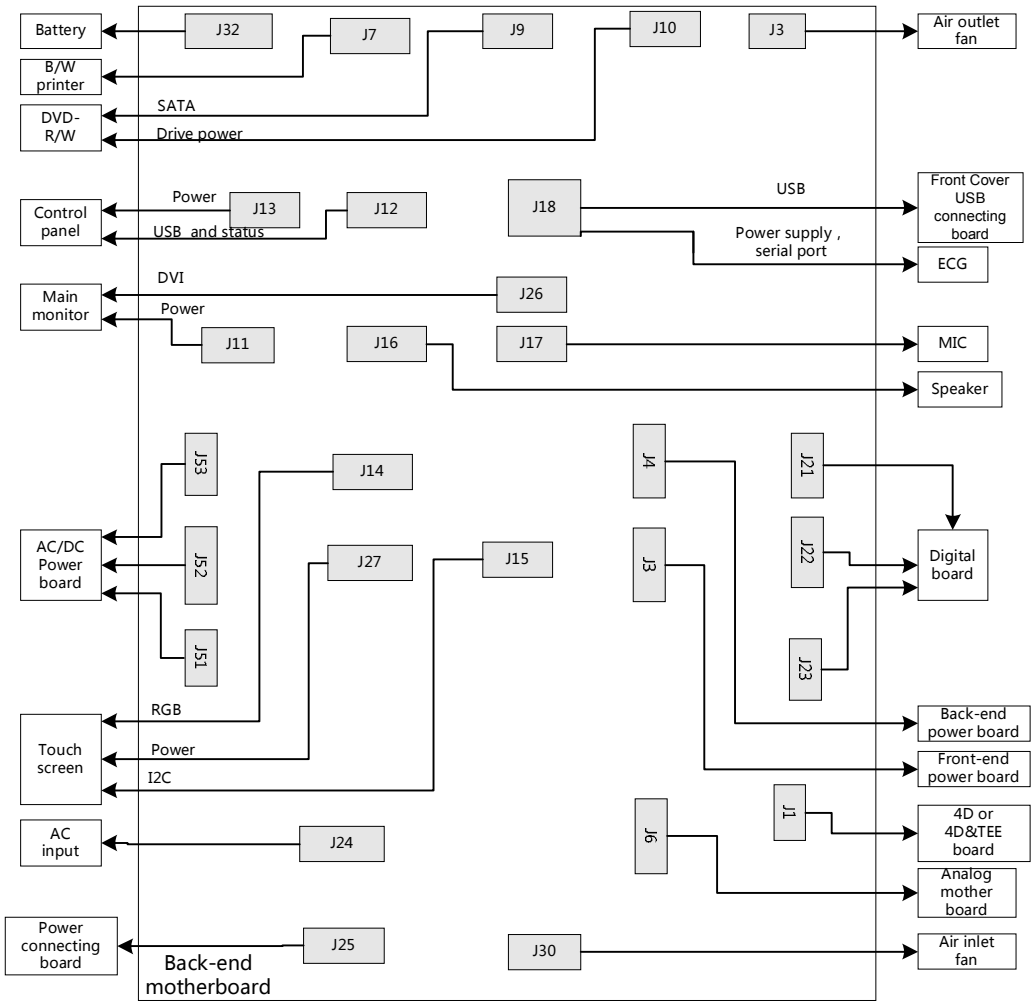


Fig 4-16 Back-end Motherboard Connection

The figure above shows the cable and socket connection on the back-end motherboard, and the connection with the other boards and modules.

4.3.6 Ultrasound System Monitoring

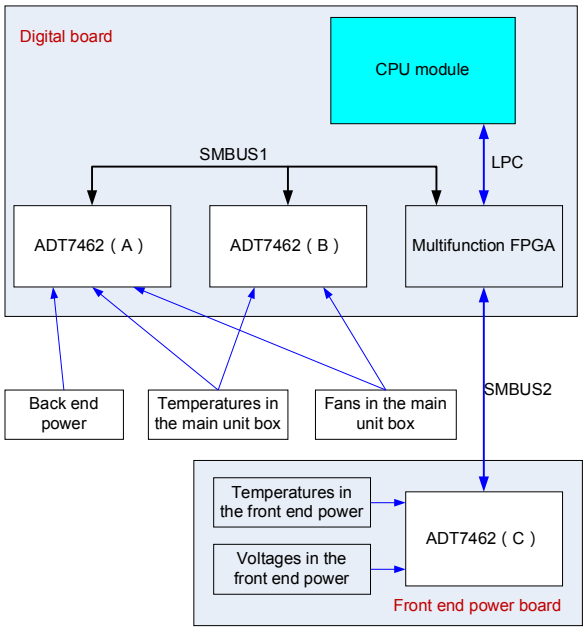


Fig 4-17 Block Diagram of Ultrasound system monitoring

Function description:

- Use ADT7462 chip to monitor system voltage, temperature and fans, Circuit structure is shown in the figure above.
- The communication between CPU and ADT7462 is realized by the SMBUS supported by FPGA.
- Two pieces of ADT7462 on the digital board are used for main unit box fan, back-end power monitor and main unit box temperature monitoring.
- 1 piece of ADT7462 on the front-end power board is used for front-end power monitor and temperature monitoring.

4.3.7 Indicators on the Ultrasound System

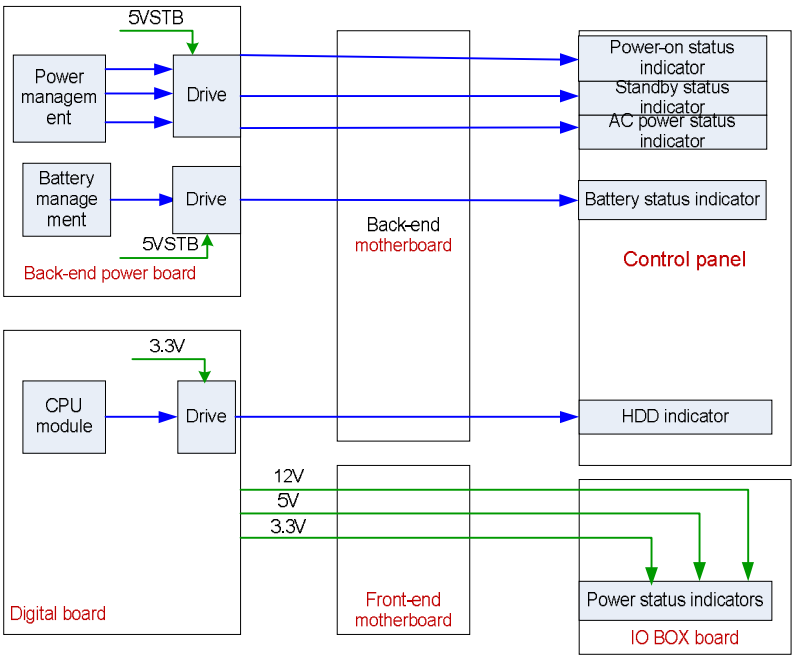


Fig 4-18 Block Diagram of Indicators on the Ultrasound System

4.4 Control Panel Unit

The control panel unit mainly consists of keyboard module.

The keyboard module consists of on/off key, retractable keyboard, trackball, TGC slider, and encoder, including key volume and key light. The key, trackball, TGC and encoder are used for signal input, key volume and key light for output.

USB HUB is adopted for USB extending on the keyboard. See the figure below, the following function circuits are designed on the control panel.

- On/off key circuit;
- TGC adjust circuit;
- Trackball circuit;
- LED drive control circuit;
- Key volume circuit;
- FPGA control circuit;
- Encoder circuit;
- USB HUB circuit.

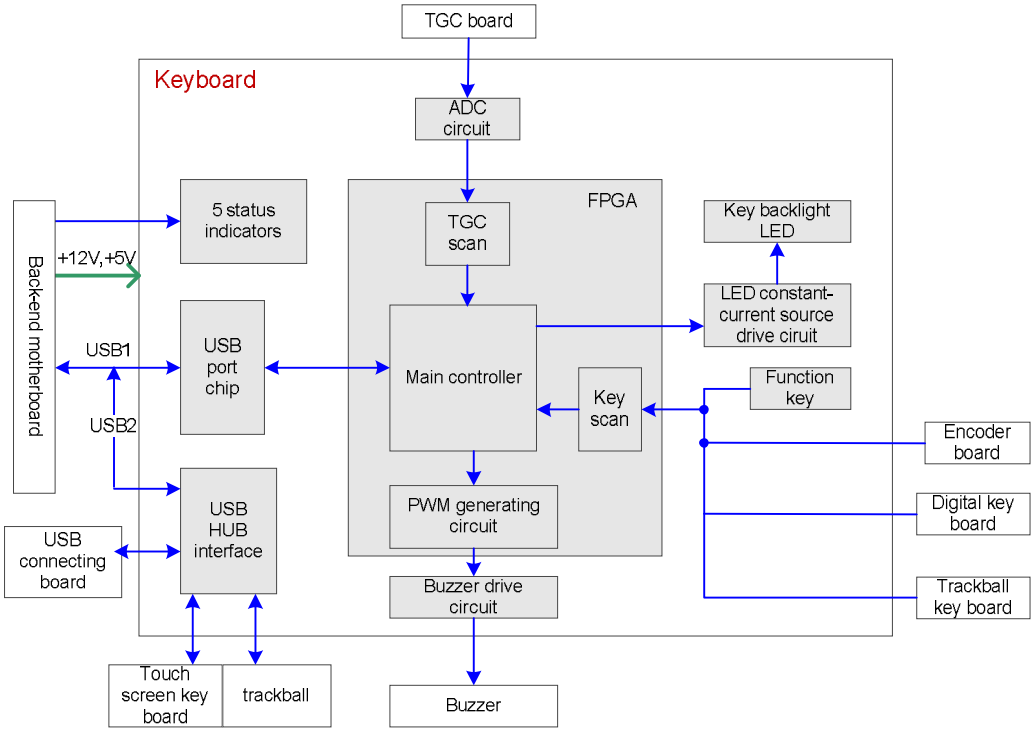


Fig 4-19 Schematic diagram of control panel

4.5 ECG&PCG Unit

ECG&PCG unit, which mainly consists of ECG&PCG board, takes charge of ECG signal detection, PCG signal monitor. After amplification, filtering, sampling and R-wave detection, the ECG/PCG signal will be sent to DSP board. The detected ECG triggering signal will be sent to the uploading logic on the DSP board through serial port, and then the signals will be sent to CPU module with other image data.

The system can be connected with ECG leads and PCG transducer; the ECG leads are compatible with the port on the patient monitor device of Mindray. Besides, USB extend board is adopted in the ECG&PCG unit. USB signal from the digital board will be sent to USB extending board through cables. For the user's convenient, two USB ports are designed on the USB extending board. Structure of ECG&PCG unit is described as below:

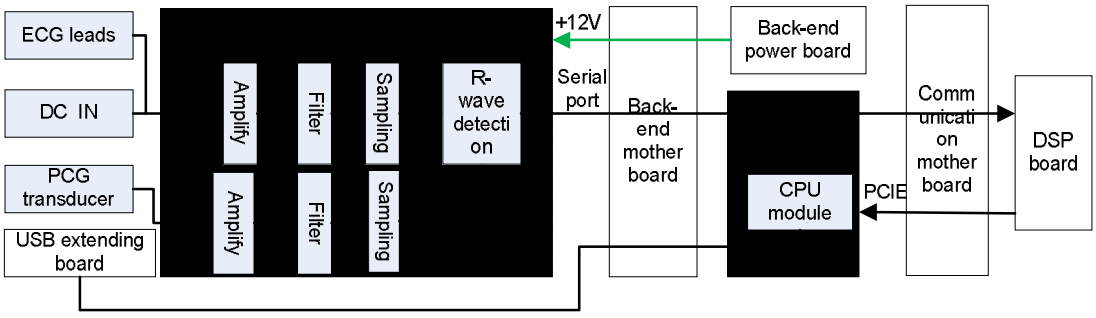


Fig 4-20 Schematic diagram of ECG&PCG unit

4.6 Main Monitor Unit

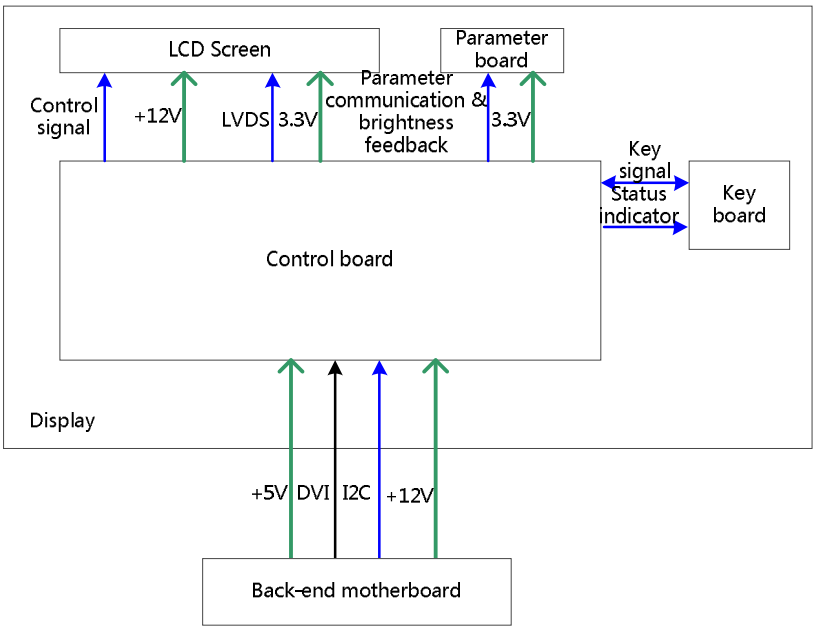


Fig 4-21 Schematic diagram of the display

The display unit mainly consists of control board, LCD screen, parameter board, key board, etc.

Function:

- The control board, as the main part of the monitor, transfers DVI input into LVDS signal then output to the LCD screen, monitors other board or signal; meanwhile, it can communicate with the main system through I2C port. So it is convenient for the main system gathering/controlling information from the monitor.
- Parameter board saves data of color temperature and gamma correction, and it is used with LCD screen, so that the corresponding display effect shall be consistent. Meanwhile, it monitors the backlight brightness of LCD. The control board will adjust the LCD backlight brightness according to the current, transferring efficient of backlight or temperature changed, the brightness of LCD screen can keep stable.
- User can adjust part of the monitor parameters through key and menu.

4.7 Touch Screen Unit

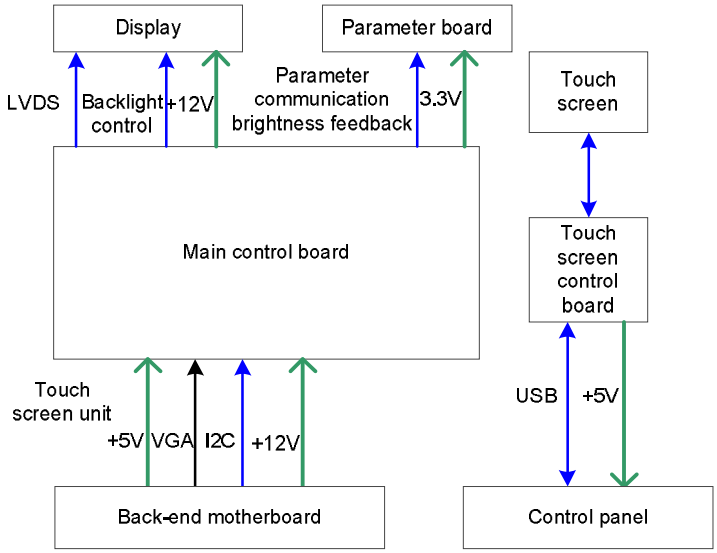


Fig 4-22 Schematic diagram of touch screen

Touch screen unit mainly consists of main control board, parameter board, LCD, touch screen, touch screen control board, etc.

Function:

- Touch screen: 10.4 inches, 5-line resistor
- The touch screen control board controls the touch screen, responds to the touch screen operation, and communicates with the main system through USB port.
- The main control board transfers the VGA input into LVDS signal output to the LCD screen, and monitors other boards or signal.
- The parameter board communicates with the main control board, controls the parameters and brightness feedback.

4.8 Power Supply Unit

Power supply unit provides power to the system (front-end, back-end, peripherals, etc.). The power supply unit consists of power connecting board/isolation transformer, AC-DC power board, front-end power board, back-end power board, and battery module, etc. Of which, the front-end power board consists of front-end power main board and front-end auxiliary board.

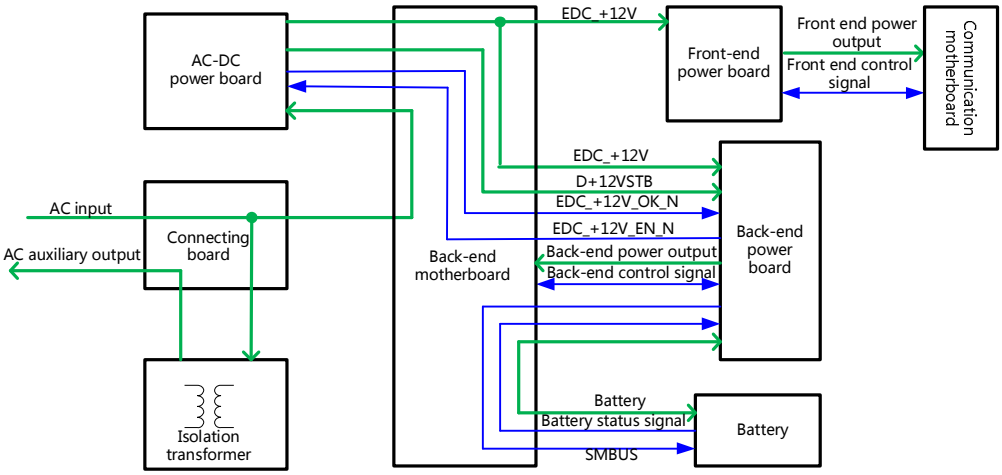


Fig 4-23 Schematic Diagram of Power System

The mains power goes to the connecting board through the circuit breaker, it will provide power to AC-DC power board after transferring, besides, it provides AC auxiliary output for peripherals (printer, e.g.) after isolation transforming. Once the AC-DC power board is powered by the mains power, it will provides D+12VSTB, which will power the Standby circuit on the back-end power board. When received the system startup command EDC_+12V_EN_N, EDC_+12V will be output to power the front-end power board, back-end power board and other +12V required. Other DC power in the front-end and back-end will be generated from DC-DC conversion through front-end power board and back-end power board.

Back-end control signal mainly consists of: system start-up/shut down logic, system status indicating, temperature gathering, battery management, etc. Front-end control signal mainly consists of power monitoring, temperature gathering and voltage programmable control, etc.

For details about the boards of power supply unit, please refer to the following chapters.

4.8.1 Connecting Board

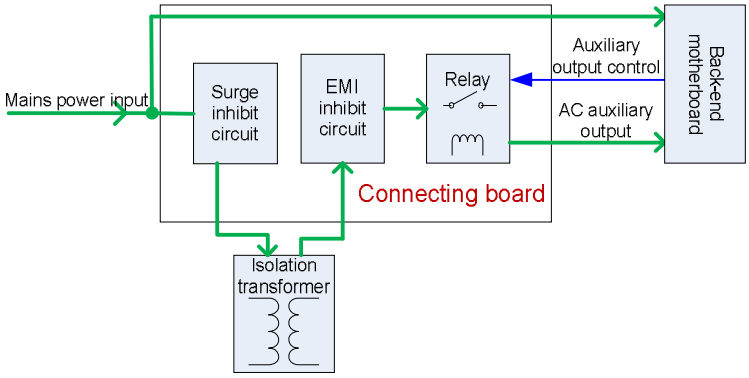


Fig 4-24 Schematic diagram of connecting board

As the connection and current distributing part for mains power input, this part consists of connecting board and isolation transformer.

Function:

- Isolation transformer: realize AC auxiliary output power and mains power electrical isolation.
- Connecting board: provide connections ports for mains power input, isolation transformer, mains power output, AC auxiliary output or signal connection ports, meanwhile, it controls the On/Off of AC auxiliary output.

4.8.2 AC-DC Power Board

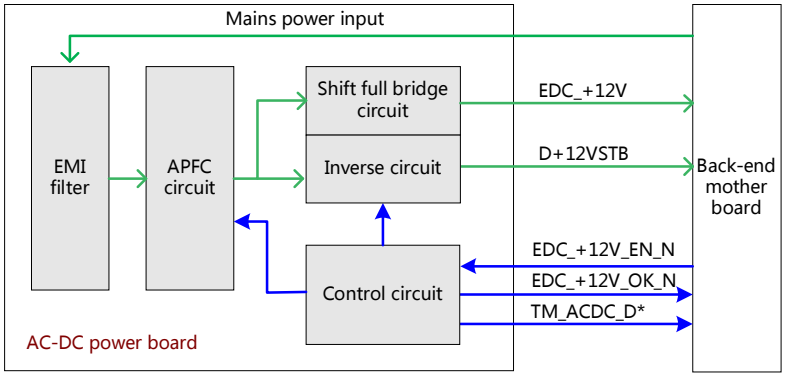


Fig 4-25 Schematic Diagram of AC-DC Power Board

Function description:

- The mains power is input to AC-DC power board after pass through the back-end motherboard, pass through the EMI filter circuit, been rectified and filtered, then activate the inverse circuit working, then output D+12VSTB to the back-end motherboard to provide power to the back-end power board, and then the APFC circuit will work normally. When system is turned on, it outputs EDC_+12V to power the front-end power board and back-end power board.
- The main power of AC-DC power board is EDC_+12V; maximum rated current is 55A, realized by shift full bridge circuit and synchronous rectification. EDC_+12V output is controlled, when the system is turned on, the enable signal EDC_+12V_EN_N is low, power output is normal, otherwise there is no EDC_+12V output.
- Output the board temperature and status signal of main power.

4.8.3 Back-end Power Board

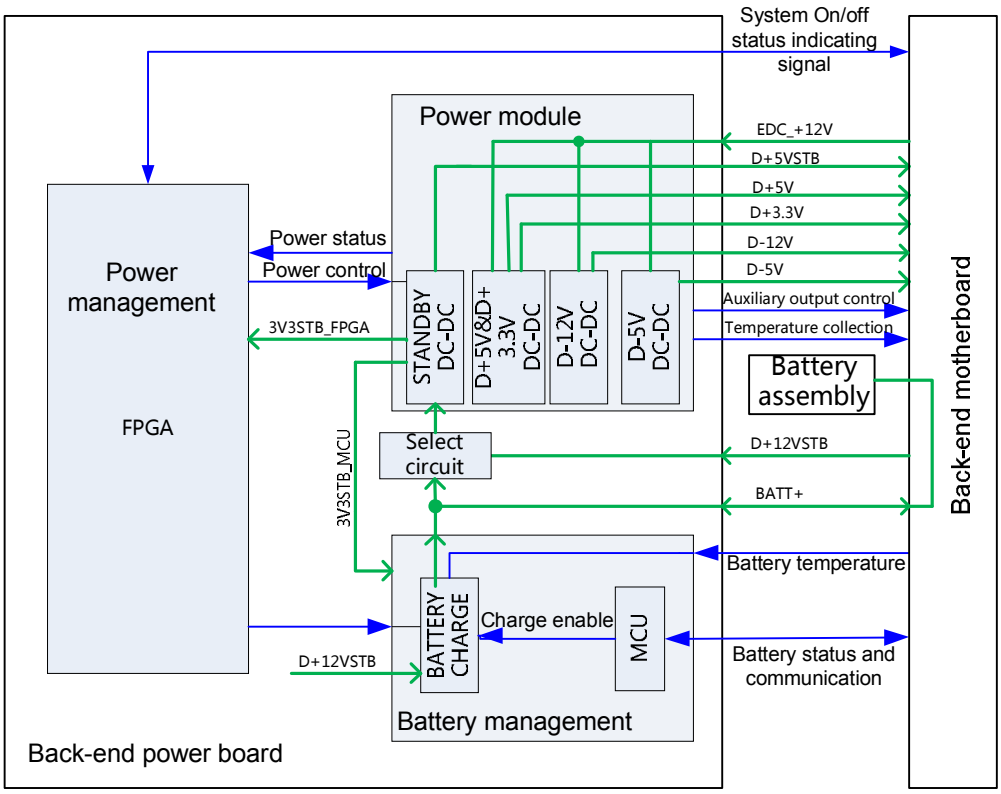


Fig 4-26 Schematic Diagram of the Back-end Power Board

Function description:

- Back-end power board mainly consists of power management, battery management and DC-DC power module. When the D+12VSTB of pre-level AC-DC power starts working, the corresponding power management and batter management part begin to work, the system enters into Standby mode, and the battery charge (supplied by D+12VSTB) circuit begins to work.
- The back-end power board, according to the CPU module status information and the FPGA and battery current information. After the system is turned on, the powers except Standby will output normally, to power the back-end boards. When system is in boot-trap status, the power charge circuit still works normally.
- When the machine is configured with battery, the machine can enter into standby mode when it is powered on by mains power. And when the mains power is cut off, the battery will power the system to make the system maintain in standby mode, until the battery is of low capacity or the mains power is connected again. The battery only supports Standby mode. And in this mode, the mains power is prior to the battery.

4.8.4 Front-end Power Board

The front-end power board consists of front-end power main board and front-end power auxiliary board. See the figure below, the external ports of the front-end power board are realized by the front-end power main board, the front-end power auxiliary board is connected with the front-end power main board, but not connected with the other boards. The EDC_+12V is connected to the front-end power main board through the back-end motherboard, meanwhile it is connected to the front-end power auxiliary board to power the two boards. They are introduced respectively as follows:

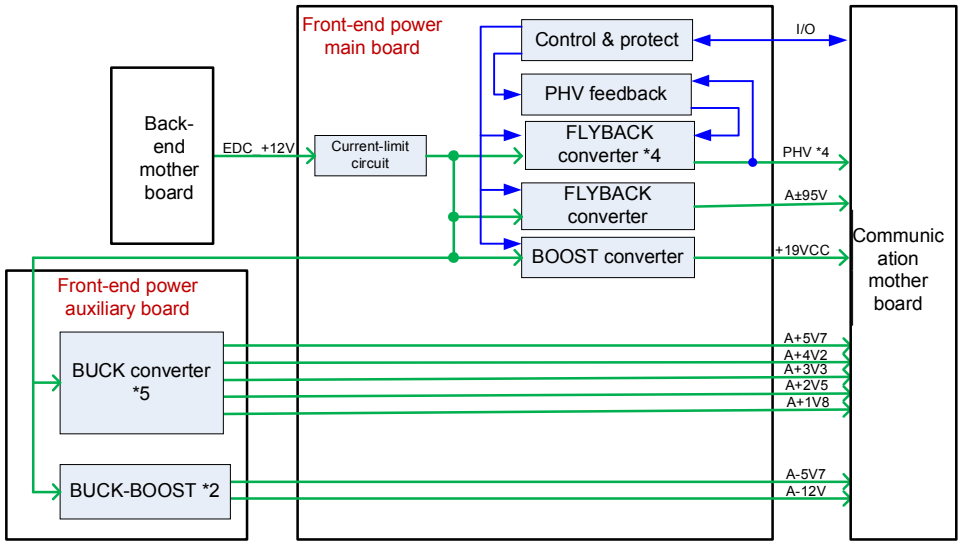


Fig 4-27 Schematic Diagram of the Front-end Power Board

4.8.4.1 Front-end Power Main Board

Function description:

- The front-end power main board mainly generates the ultrasound transmission power, including 4 channels adjustable voltages PHV, 2 channel fixed voltages A±95V, 1 channel +19VCC output ,and transfers all the powers generated by the power auxiliary board.
- PHV control and feedback circuit mainly include three parts: ARM, ADC sampling and operation & amplification. Main system CPU module can directly determine PHV voltage and read the output voltages of each power (including the outputs from front-end power auxiliary board).

Power sequence:

- After each circuit module on the board is started, PHV and ±HV are still kept closed, PHV and ±HV will be started only if the IC received the commands from CPU module, PHV output voltage is determined by the commend of CPU module.

4.8.4.2 Front-end Power Auxiliary Board

Function description:

- Front-end power auxiliary board transfers +12V into +5.7V, +4.2V, +3.3V, +2.5V, +1.8V, -5.7V, -12V, etc., which will power the front-end circuit. Current from +5.7V, +4.2V, +1.8V are great, so bi-channel intervening parallel BUCK convertor is adopted, +3.3V, +2.5V current output is small, they use one IC together. -5.7V, -12V use BUCK-BOOST topological circuit.
- The power auxiliary board is directly inserted on the power main board, but there is no electrical control. Only the output and input of the power auxiliary board are transferred through the power main board, meanwhile, the power main board will sample all the voltages and then report them to the main system.

Power sequence:

- Each circuit unit is independently controlled, they are started when the power is input, no confirmed order.

4.8.5 Power and the Supported Functions Distribution

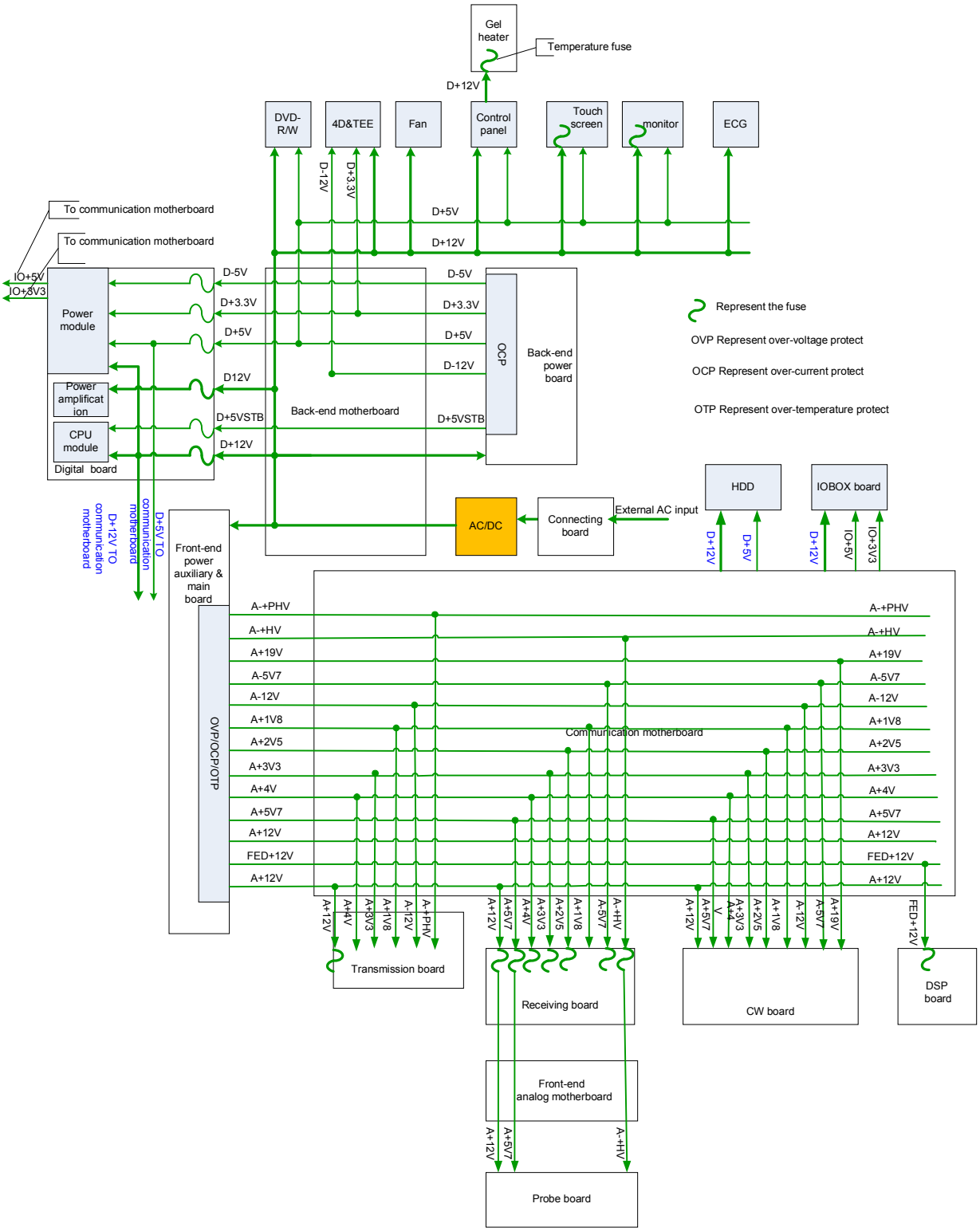


Fig 4-28 Schematic Diagram System Power Distribution

No.	Power description	Supported circuit module or function	Notes
1	A+12V	Transmission board, receiving board, CW board	Provide by front-end power auxiliary board
2	FED+12V	DSP board	Provide by front-end power auxiliary board
3	A+5V7	Receiving board, CW board, probe board	Provide by front-end power auxiliary board
4	A+4V2	Transmission board, receiving board, CW board	Provide by front-end power auxiliary board
5	A+3V3	Transmission board, receiving board, CW board	Provide by front-end power auxiliary board
6	A+2V5	Receiving board, CW board	Provide by front-end power auxiliary board
7	A+1V8	Transmission board, receiving board, CW board	Provide by front-end power auxiliary board
8	A-12V	Transmission board, CW board	Provide by front-end power auxiliary board
9	A-5V7	Receiving board, CW board	Provide by front-end power auxiliary board
10	A+100V	Probe board	Provide by front-end power main board
11	A-100V	Probe board	Provide by front-end power main board
12	A+19V	CW board	Provide by front-end power main board
13	PHV1P/N	Transmission board	Provide by front-end power main board
14	PHV2P/N	Transmission board	Provide by front-end power main board
15	D+12V	CPU module, speaker and power-amplifier, HDD, DVD-R/W, control panel, touch screen, monitor, gel heater, ECG/PCG,4D or 4D&TEE board	Provide by back-end power board
16	D+5V	Digital board, HDD, DVD, USB port, control board	Provide by back-end power board
17	D+3V3	Digital board, 4D or 4D&TEE board	Provide by back-end power board
18	D-5V	Digital board	Provide by back-end power board
19	D-12V	4D or 4D&TEE board	Provide by back-end power board
20	5V_STB	CPU module	Provide by back-end power board
21	3V_STB	Back-end power board	Provide by back-end power board

4.8.6 System power on control

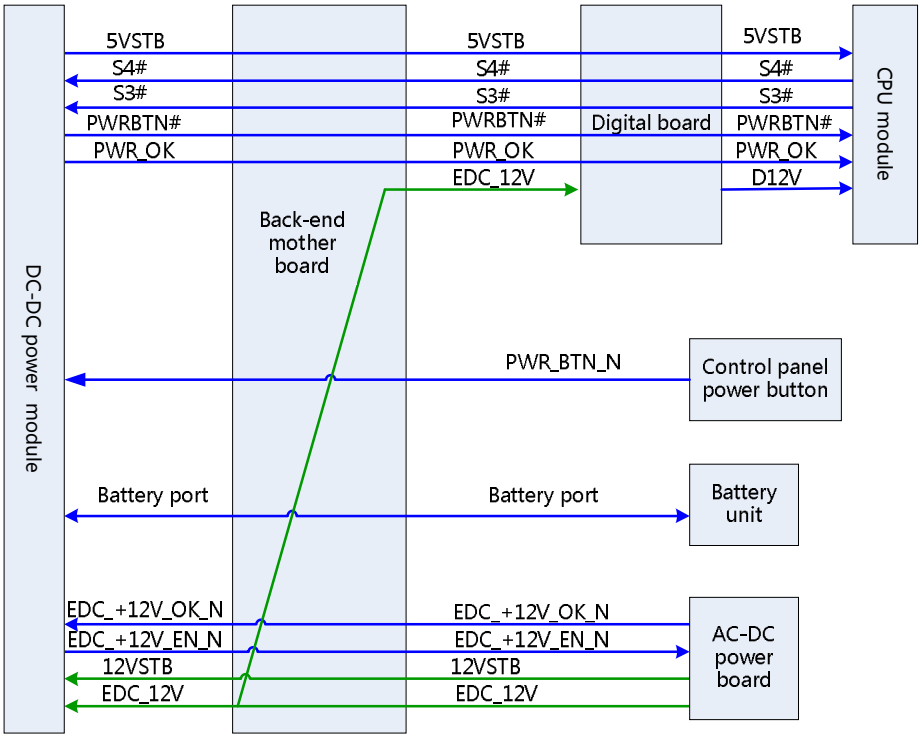


Fig 4-29 System power on control

- The related control signals:

No.	Control signal	Explanation	Remarks
1	PWR_BTN_N, PWR_BTN#	The pulse signal, which is generated by the control panel power button, is transferred to the CPU module through power management FPGA, for system being turned on.	
2	S3#	CPU module output, effective means CPU system is in standby mode (S4# is high), the power management FPGA controls 5VSTB, in system standby mode, it is powered.	
3	S4#	CPU module output, effective means CPU system is in hibernation mode.	
5	EDC_+12V_EN_N	Power management FPGA output to AC-DC power board, controls the power of power module except 5VSTB_CPU and 3V3STB, low level is effective.	
6	EDC_+12V_OK_N	12V power finished signal from AC-DC power board	
7	PWR_OK#	From power management FPGA to CPU module, means 12V power is finished.	
8	12VSTB	From AC-DC power board to DC-DC module, for generating 3.3VSTB and 5VSTB, if there is AC input, the power will keep effective.	

- The main system is completely AC powered, the battery only to be used for standby mode, the battery provides 12VSTB if there is no AC input, the system can't be turned on.
- Only if there is AC input, 12VSTB power will generate 5VSTB and 3.3VSTB.

- When system is shut down, disconnect the AC power, when the battery is in use, the battery management will shut down the 5VSTB and 3.3VSTB output, that is to say, the power management itself will be powered off until AC powered on.
- On standby mode, disconnect the AC power, when the battery is in use, the battery provides 12VSTB power, and transfers into 5VSBT and 3.3VSTB for system use in standby mode.

The power on process is shown as below:

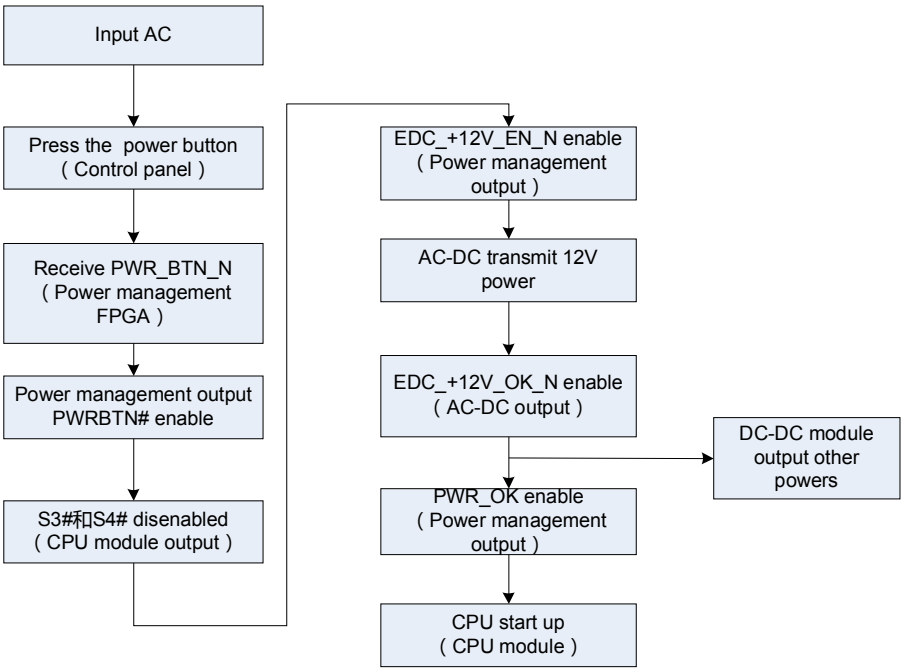


Fig 4-30 System power on Process

5 Function and Performance Checking Method

5.1 Note

The chapter supplies the detailed method for product main function and performance checking. This is used for referring or studying by engineer but not required.

5.2 System Running Status

5.2.1 Running Status

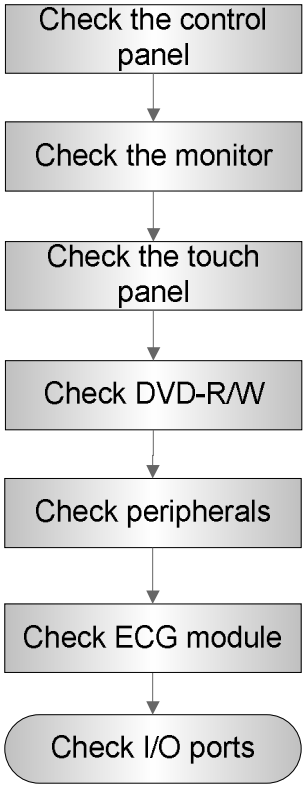
1. Power on/off normal (duration time is normal), no abnormal sounds or phenomena occur during normal operation.
2. After ultrasound system is turned on, the fan starts working and no abnormal sound when the fan is working.
3. Check if configuration, software version are normal through the [About] in preset menu.
4. Check if contrast and brightness of the monitor are normal.
5. Check if time and date are valid and correct.
6. Check if all status indicators are normal.
7. Check all log records with user, to confirm if there is any abnormality.

5.2.2 Working Condition

Check the ambient temperature and humidity. The measurements related to safety features are particularly sensitive to humidity. If the insulation feature of the system deteriorates due to the increase of system service time or system malfunctions, the fluctuation range of measurement results are likely to increase with the increase of humidity.

5.3 General exam

5.3.1 Check Flow



5.3.2 Checking Content

5.3.2.1 Check Control Panel

Procedure	Checking standard
check all buttons, keys and knobs Follow the direction: left to right, and up to down.	All keys and knobs are effective.
Function checking of the trackball: ■ Press the <Freeze> key to enter the Freeze status. ■ Press <Measure> to enter into measure status, do vertical and horizontal measurement, or do other trackball operations.	The trackball can be rotated easily; the cursor responds sensitively, the rotation direction is the same as the direction of the cursor.

5.3.2.2 Check the Monitor

Procedure	Standard
■ Adjust LCD brightness ■ Adjust LCD contrast ■ Enter [Preset]->[General], click [Contrast/Brightness Load Factory] ■ Monitor maintenance Log on as Service, click [Maintenance]->[Test Main Monitor] to check the monitor functions	■ Press “+”, the brightness increases; and press “-”, the brightness decreases. ■ Press “+”, the contrast increases; and press “-”, the contrast decreases. ■ Brightness/Contrast load factory values ■ Click each functional button, the LCD responds correctly, the standard is as follows: 1. Light-spot: 0; flash point: 0. 2. The adjoining dark spots are no more than 3 pairs, and there is no adjoining dark spot in image area. 3. There is no adjoining dark spot of 3 or more than 3. 4. The dark spots are no more than 7 and those in the image area are no more than 2 5. The distance between bad spots is no less than 5mm. Note: image area refers to rectangle when the background is black/right.

5.3.2.3 Check Touch Panel

Procedure	Standard
■ Check if keys on the touch screen of B or M exam mode can respond normally. ■ Enter [Maintenance]->[Touch Screen Preset] to enter the touch screen contrast/brightness menu.	■ All keys function are effective. ■ Press on the touch screen to adjust the values, real-time values will be displayed on the adjusting bar.

5.3.2.4 Check DVD-R/W

Procedure	Standard
■ Press [Eject] ■ Use the optical disk drive to read and burning.	■ Disk can be normally ejected. ■ Normal, no abnormal sounds.

5.3.2.5 Check Peripherals

Procedure	Standard
Footswitch: Connect the footswitch; check the functions of footswitch according to the functions listed in Key Config. （e.g. right key- image frozen, middle key- color print, left key- B/W print）	■ Press the freeze key (the right key), image is frozen, the freeze menu is displayed; press the key again, image is unfrozen. ■ Press the print key (middle key), color printing starts. ■ Press the print key (left key), B/W printing starts.
Video printer: Check if the video printer and ultrasound system are correctly connected. Then check the function of each key.	Press <Print> key, the printer begins to work, no image print deficiency or degradation. Switch video output port; repeat the step.

Text/graph printer: Check if the printer and ultrasound system are correctly connected. Then check the function of each key.	Press <Print> key, the printer begins to work, no print deficiency or degradation.
Code bar scanner: Perform code bar scanning when the ultrasound system is running normally.	The bar code is correctly displayed on the screen.

5.3.2.6 Check ECG Module

Procedure	Standard
Confirm if the ECG module is configured, then: Set [ECG] as “On”.	■ ECG trace is displayed; the heart icon is displayed at the upper right corner of the screen. ■ The parameters [Speed], [ECG Gain] can be adjusted. ■ ECG signal can be reviewed correctly.

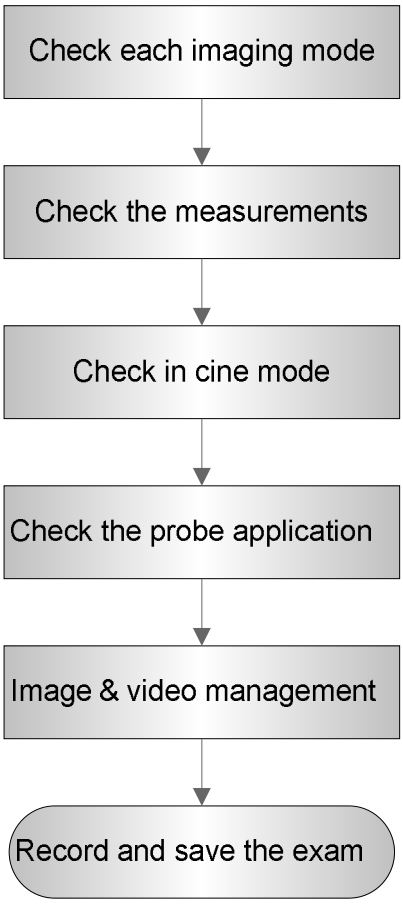
5.3.2.7 Check I/O Ports

Procedure	Standard
Checking the main I/O ports: Besides the video/audio ports, USB ports, the other ports required to be checked including: VGA/DVI port; Connect external VGA/LCD monitor (with resolution supporting 1680*1050) Network port; Other USB ports.	■ The contents displayed on the VGA/LCD are the same as those displayed on the ultrasound system displayer, no character and image loss, no color difference, no fluttering and flicking. ■ Smooth communication. ■ USB port data storage/accessing are normal.

5.4 Function Checking

NOTE:	A complete function inspection is described here, do the checking according to the actual system configuration.

5.4.1 Checking Flow


Check each imaging mode
Check the measurements
Check in cine mode
Check the probe application
Image & video management
Record and save the exam

5.4.2 Content

5.4.2.1 Imaging Modes

1. B mode

- In B Mode scanning, the image parameter area in the upper left corner of the screen will display the real-time parameter values as follows:

Parameter	F	D	G	FR	DR	iClear	iBeam	iTouch	Zoom
Meaning	Frequency	Depth	Gain	Frame Rate	Dynamic Range	Display when the function is turned on.			

- Parameters that can be adjusted to optimize the B Mode image are indicated in the following.

Adjustment method	Procedure	Standard
Control Panel	Depth	Changes image display depth----<Depth> deflector rod.
	TGC	Manually adjust time gain compensation---- TGC slider.
	Gain	Changes the B mode gain---- <B> knob.
	iTouch	Image auto-optimization----press <iTouch>.
	Focus Position	Changes the focus position----<Focus> deflector rod.
	Steer	Changes B steer angle of linear probe----<Steer> deflector rod.

Touch Screen	Image Quality	Changes the current probe frequency.
	Tint Map	Turns on/off the colorize function; Selects among available colorize maps.
	Invert	Inverts the image vertically or horizontally.
	Rotation	Rotates an image at an angle of 90° each time.
	FOV	Adjusts the scan area.
	ExFOV	Turns on/ off ExFOV function of probe to extend image range.
	Image Merge	Merges images of two windows in Dual mode.
	Dynamic Range	Adjusts contrast resolution of an image, compresses or expands gray display range.
	Gray Map	Selects among post processing map curves to optimize grayscale images.
	Line Density	The function determines the quality and information of the image.
	Focus Number	Changes the number of focuses.
	iClear	Increases image profile, so as to distinguish the image boundary.
	TSI	Optimizes the image by selecting acoustic speed according to tissue characteristics.
	Persistence	Removes image noise to make details to be clearer.
	iBeam	Superimposes and averages images of different steer angles to obtain image optimization.
	HScale	Display or hide the width scale (horizontal scale).
	Dual live	Display different image effects of one probe.
	LGC	Adjust gain of scan lines to increase the image lateral resolution.
Touch Panel	A. power	Selects the acoustic power value.

2. M mode

- In M mode scanning, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:

Parameter	F	D	G	V	DR
Meaning	Frequency	Depth	M Gain	M speed	M Dynamic Range

- Parameters that can be adjusted to optimize the M Mode image are indicated in the following.

Control Panel	Gain, Depth,TGC,Focus Location
Touch Screen	Speed, Display Format, Gray Map, Dynamic Range, Tint Map, M Soften, Edge Enhance

3. Color mode

- In Color mode scanning, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:

Parameter	F	G	PRF	WF
Meaning	Frequency	Color Gain	Pulse Repetition Frequency (PRF)	Color Wall Filter

- Parameters that can be adjusted to optimize the Color Mode image are indicated in the following.

Control Panel	Gain, Depth, iTouch, Steer, Scale
Touch Screen	Invert, Baseline, B/C Wide, Dual Live, Image quality, Flow State, Priority, Packet Size, Map, Wall Filter, Line Density, Smooth, Persistence, Velocity Tag

4. Power mode

- In Power mode scanning, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:

Display	F	G	WF	PRF
Parameter	Frequency	Power Gain	Power Wall Filter	Pulse Repetition Frequency

5. PW/CW mode

- The parameters will be displayed in the image parameter area on the left part of the screen as follows:

Display	F	G	PRF	WF	SVD	SV	Angle
Parameters	Frequency	Gain	Pulse Repetition Frequency	WF (Wall Filter)	SV Position	SV Size (only CW)	Angle

- Parameters that can be adjusted to optimize the PW/CW Mode image are indicated in the following.

Control Panel	Gain, iTouch, Baseline, PW Steer, Scale, Angle
Menu	Display Format, Invert, Duplex/ Triplex, Quick Angle, Wall Filter, Image Quality, Tint Map, Dynamic Range, Trace Area, Speed, SV, Gray Map, T/F Res, Auto Calc, Auto Calc Para, HPRF, Auto Calc cycle,
Touch Panel	Volume, A. power

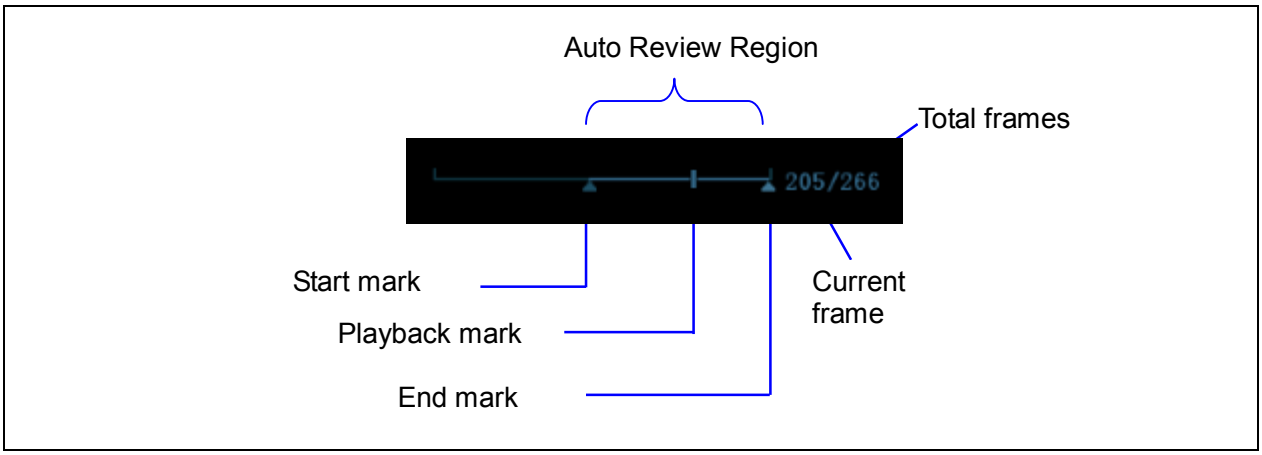
5.4.2.2 Basic Measurements

Procedure	Standard
In B image mode: Press <Measure>: Press <Caliper> key	The system enters application measurements The system enters general measurement mode. Perform any 1-2 measurements (e.g., length, area), the results will display at the lower part of the image.
Press the same key again or press <Esc>.	Exits measurement.

Procedure	Standard
Do the same operation in other image modes.	Application measurements are classified into different application packages, do the application measurements selectively.

5.4.2.3 Cine Review

Procedure	Standard
Press [Freeze] key to freeze an image, and the [Cine] key indicator lights on. The system automatically enters the manual cine status.(It has been set that when system enters into freeze mode, the default status is cine review.) Press <iStation> key, then click [Review]; or press <Review> key to open a cine file.	The system enters into cine review status The system enters into auto cine review status.
Roll the trackball	Manual cine review
Click [Auto Play] on the menu or soft menu.	Auto play function is turned on, adjust the soft menu button. The greater the value is, the quicker the speed is. When the value is 0, the system exits auto play mode.
Move the cursor onto the desired start point of the cine loop, click [Set First Frame] in the menu or soft menu to set the start point.	Set the start point of cine loop.
Move the cursor onto the desired end point of the cine loop, click [Set Last Frame] in the menu or soft menu to set the start point.	Set the end point of cine loop.
Click [Auto Play] again	Review region is confined to the set start point and end point.
Then press the [Cine] key again.	Cine review stops.
Press the <Freeze> key to unfreeze the image. Press <Cine> or <Esc> key.	Freeze indicator light is off; the system will return to image scanning and exit cine review. The images are still frozen but the system exits cine review.



5.4.2.4 Probe Switching

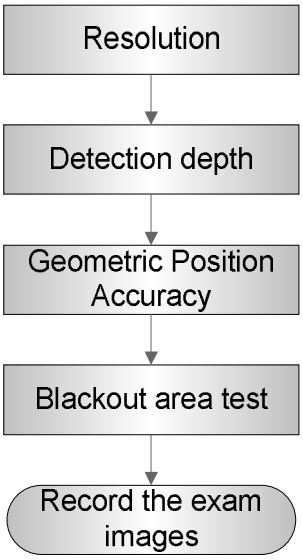
Procedure	Standard
Press <Freeze> key→ connect the probe to the system→ press <Freeze> key→ press <Probe> key to select the probe.	Connect a convex probe to probe socket A, and then connect a linear probe to probe socket B, the operator can select probe A or probe B as the active probe.
Press <Freeze> key→ disconnect the probe→ connect another probe to the port	The system can recognize the newly connected probe in no time.

5.4.2.5 Patient Information Management

Procedure	Standard
Press <Save 1> or <Save 2> (the function already set) during image scanning	Image will be saved to the patient database, and a thumbnail will be displayed at the right part of the screen.
Open [Setup] →[System Preset]→"General", then check "Send/Print Image after End Exam" in the Patient Management area. Press <End Exam> during image scanning	The system automatically sends the images of the exam to the default DICOM storage server or print server.
● Press <Review> key. ● Click [Exit] on the Review screen; or, press <Review> again, or, press <Esc> key	● The system enters into image review mode. ● The system exits image review mode.
● Click [iVision] on the other menu; or press user-defined iVision key. ● Select the contents to be demonstrated, and select the demo mode in the iVision screen. Then select an item already added to the list and click [Start] ● When the demonstration is finished, click [Exit] or press <Esc>.	● Open iVision screen: ● Demonstration begins. ● Image files are played according to file names one by one (including the image of system-relevant and PC-compatible format). ● The system exits the demonstration.
Press <iStation> key to enter patient information management (iStation page)	The saved patient information (images) can be found, and the patient information can be: ● Backed up/ Restored ● Sent (To DICOM.U disk .etc)

5.5 Performance Test

5.5.1 Test Process



5.5.2 Test Content

NOTE:	The image used here is only for reference, stick to the image effect in the real situation.

Requirements:

1. Display: set the contrast and brightness at the clinical application value (or the default status)
2. Operation environment: dark room, simulating the clinical application environment.
3. Scanning techniques: contact the probe with the acoustic window of the phantom, no spacing nor pressing.

Tips:

For the testing phantoms, please refer to Appendix B.

KS107BD is low frequency phantom and used when Probe focus frequency is less than 4MHZ;

KS107BG is high frequency phantom and used when Probe focus frequency is more than 5MHZ;

5.5.2.1 Resolution

- transverse resolution

Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the transverse resolution testing targets to be displayed around the midline of the image.

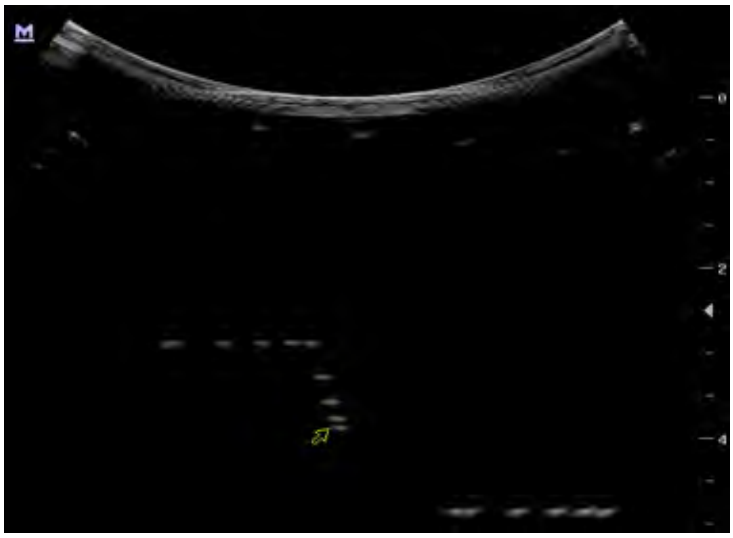
2. Adjust the focus point focuses at the position where the transverse resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.
4. In condition that the transverse resolution testing targets are horizontally displayed, record the minimal distance of two targets that can be clearly recognized.
5. Repeat the operation above for the transverse resolution testing targets at other depths.

As shown in figure below.

■ Axial resolution

Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface, making the longitudinal resolution testing targets to be displayed around the midline of the image.
2. Adjust the focus point focuses at the position where the longitudinal resolution testing targets are displayed.
3. Adjust parameters like gain, dynamic range, TGC, making the background tissue unseen, just displaying the target image clearly.
4. Record the minimal distance of two longitudinal resolution testing targets that can be clearly recognized.
5. Repeat the operation above for the longitudinal resolution testing targets at other depths.



NOTE:	1.	When using the convex probe, keep the transverse resolution testing targets to be displayed near the midline.
	2.	When using a linear probe with steer function, do not turn on the steer function when perform the transverse resolution test.
	3.	Zoom in the region where the targets located if necessary.
	4.	The diameter of the target point at a certain depth is equal to the transverse resolution at the depth.

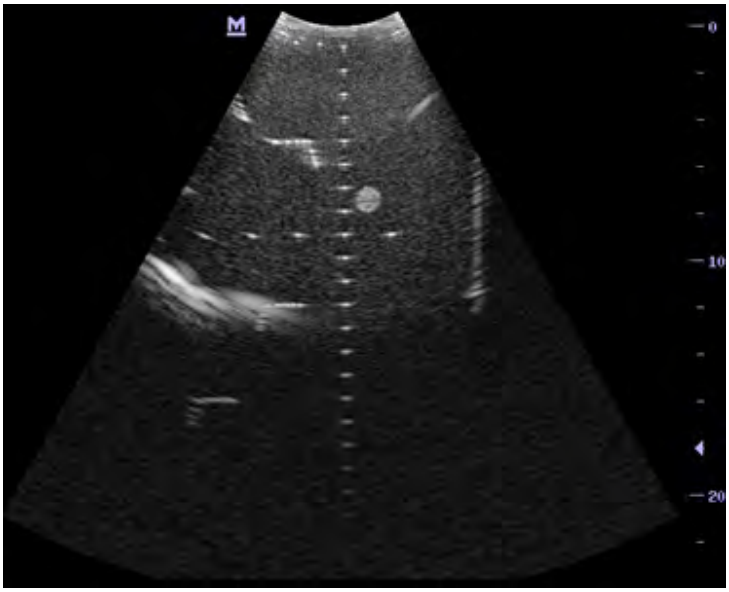
5.5.2.2 Maximum Depth

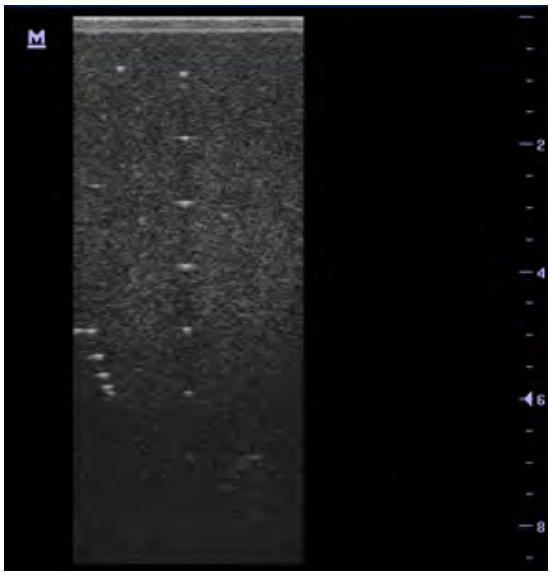
Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Set the system display depth according to the expected maximum available depth of the probe in use.
3. Adjust the focus point to the deepest, and AP at the maximum value.
4. Set gain, contrast, TGC at a greater value, but no halation nor defocus is allowed.
5. Record the depth of the furthest target (the target can be seen clearly).

NOTE:	1.	Increasing the gain will also increase the noise, and echo may be covered.
	2.	When using a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed.
	3.	When using a convex or phased-array probe, make the axis targets to be displayed at the middle of the scanning image.
	4.	When system is not frozen, the fast field target information may be similar to that of the noise, do not use this target.

As shown in figure below.


M
0
10
20


M
2
4
6
8

5.5.2.3 Geometric positioning accuracy

■ Longitudinal geometric positioning accuracy

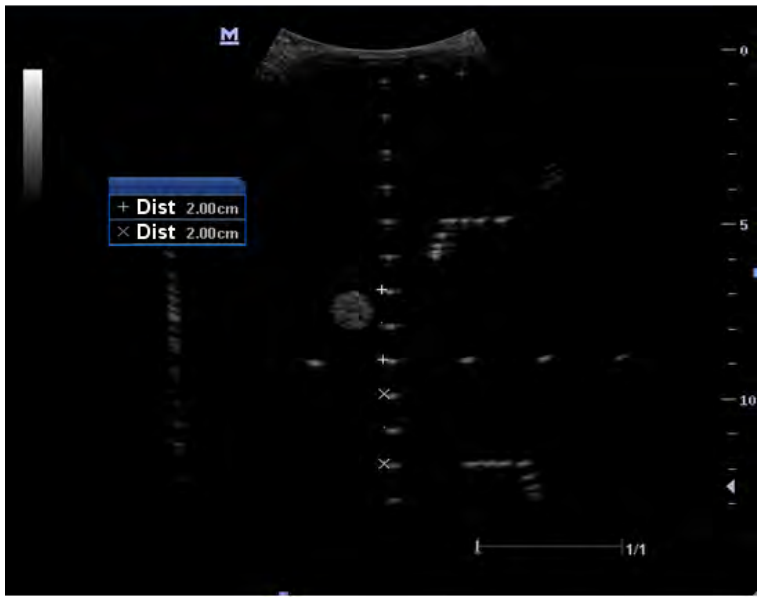
Test Step:

1. Do adjustments as the way in testing the maximum depth.
2. Record the distance by 20mm each segment on the longitudinal targets line using the measurement caliper;
3. Select the value with the greatest error (to 20mm), calculate the accuracy using the formula below

$$\text{Geometric Position Accuracy (\%)} = \left| \frac{\text{Measured value-Actual distance}}{\text{Actual distance}} \right| \times 100$$

NOTE:	1. The measurement caliper should be positioned at the upper edge of the target, not the middle nor the lower edge. 2. The scanning plane should be vertical to the target line, that means the scanning plane is parallel with the cross-section of the phantom

As shown in figure below.



■ Transverse geometric positioning accuracy

Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth, making the transverse targets to be displayed in the image.
3. Adjust the focus point to be posited beside the transverse targets (the standard is not clear)

4. Adjust parameters like gain, TGC, making each transverse targets to be clearly displayed.
5. Record the distance by 20mm each segment on the transverse targets line by using the measurement caliper
6. Select the value with the greatest error (to 20mm), calculate the accuracy by using the formula below

$$\text{Geometric Position Accuracy (\%)} = \left| \frac{\text{Measured value-Actual distance}}{\text{Actual distance}} \right| \times 100$$

NOTE:	1.	When using a linear probe, record the transverse distance by segment.
	2.	When using a convex probe, all transverse targets should be displayed integrally in an image.
	3.	The measure caliper should be posited at the upper side or lower side of the target center.

As shown in figure below.

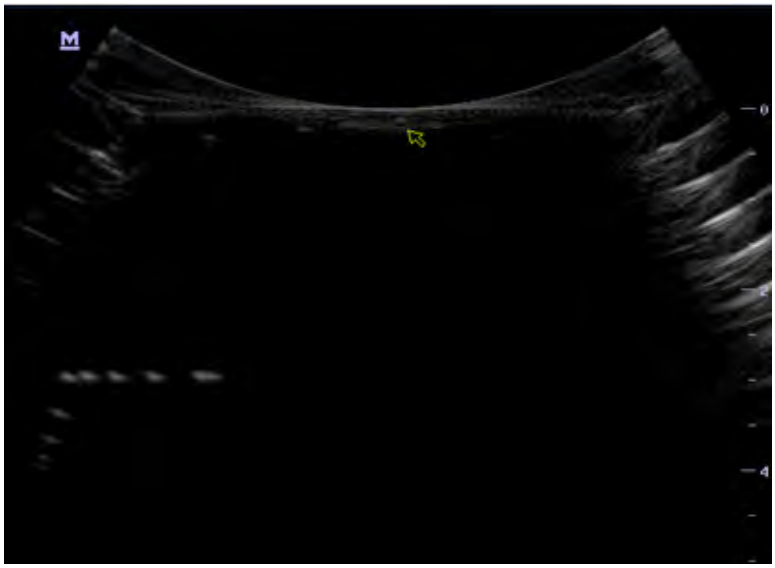
5.5.2.4 Blackout Area

Test Step:

1. Cover the scan surface of the phantom with water or couple gel, gently contact the probe with the scan surface
2. Adjust the depth at a lower value, and set the focus at the nearest place to the scan surface.
3. Decrease the value of parameters like AP, Gain until the background noise just can be seen.
4. Record the smallest depth of the target that can be seen clearly, that value is the blackout area value.

NOTE:	1. When using a linear probe, please completely contact the probe with the scan surface, no side clearance is allowed. 2. For convex probe, the targets in the blackout area should be positioned on the midline of the scanning plane.

As shown in figure below.



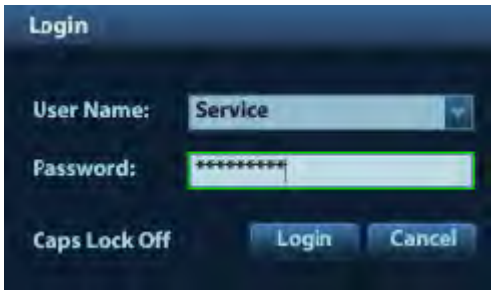
6 Software Installation &Maintenance

6.1 Enter into Maintenance

NOTE:	Before maintenance operation, the engineer should log in the system as Service.

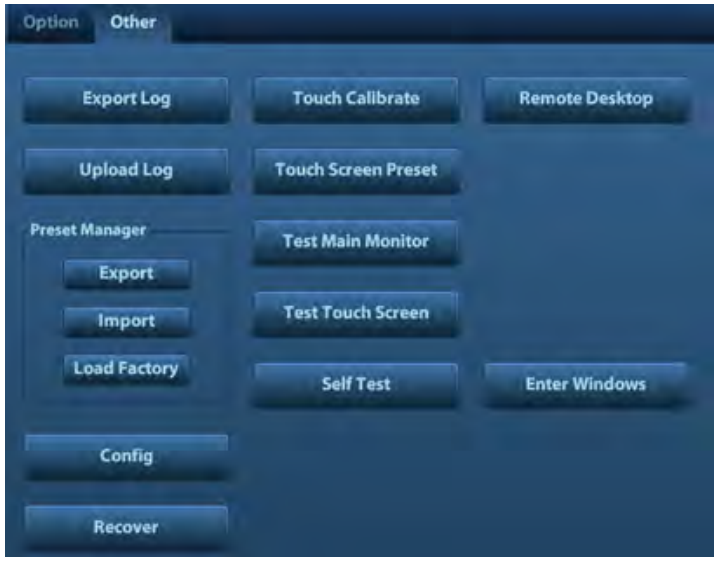
Procedure:

1. When Access Control is disabled: press “ctrl”+“/” to pop up the Log in dialogue box, select Service as the user name.



2. When Access Control is enabled, press “ctrl”+“/” on the login dialogue box to show the inner users, select Service to login.

3. Press <F10> key to open the Setup menu, click [Maintenance] and then select the target items to perform the maintenance respectively.



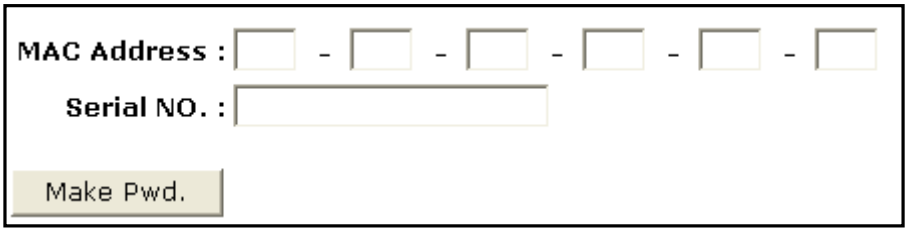
6.2 Software Installation/Restoration

Please refer to the system recovery guide for details.

⚠WARNING:	1. **Back up the patient data and preset data before restoring the system.** 2. **Do not cut off power, shut down or restart the system during system restoring.**

6.3 Enter into Windows

1. Open the webpage: <http://apollo.mindray.com/ukmo/ >, click [Make Pwd] to open the following page after logging in.



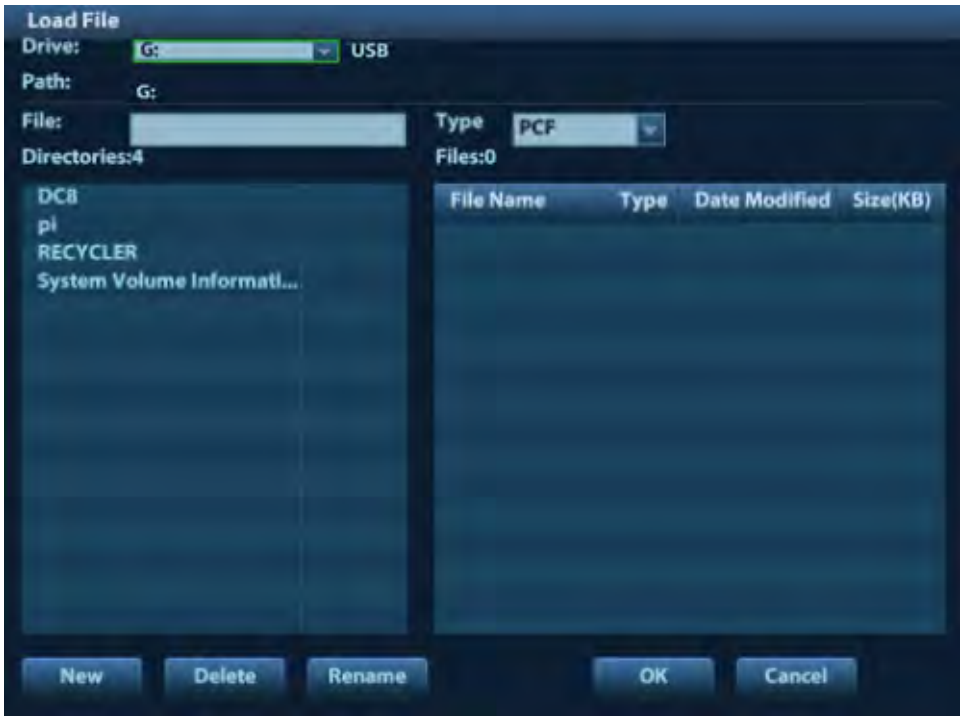
2. Input the MAC address and Serial NO. (Please refer to the System Information), click [Make Pwd] to obtain the password for entering Windows.
3. Click [Enter Windows] on the Maintenance menu, then input the password just obtained to enter into Windows.

6.4 Software maintenance

6.4.1 Product Configuration

NOTE:	[Config] is available on the Maintenance menu only if the operator logged on the system as Service.

1. Make PCF file according to the product (made in the factory, for special models, the PCF file is already archived), then copy it to the USB disk. Insert the USB disk into the USB port; click [Config] on the maintenance menu to open the following dialogue box.



2. Select correct PCF files, and click [OK]. After the operation is completed, the successful prompt appears. Restart the system and the configuration takes effect.
   Special configurations including:
   Dedicated product LOGO, hospital LOGO, dormant/screen saver logo, image active/inactive symbols in dual B mode, system information, system start-up/shut down screen, etc.

NOTE:	1. System general configuration is already configured during the resume package restoration. No manual configuration is required if no special requirement. 2. Don't change the model of the machine; otherwise the key files may be lost.

6.4.2 Log Maintenance

6.4.2.1 Export the Log

NOTE:	This operation can be performed by both internal and external users.

1. Insert the USB disk to the system;
2. Click [Export Log] on the [other] page of Maintenance menu to pop up the exporting page.
3. Select the path in the Browse page to save the log, and click [OK].
4. After the log is exported, the system prompts “Export succeed!”, click [OK] to return to the Maintenance menu.

NOTE:	The log can be exported to the external USB storage device only, make sure there is enough space for storage before exporting.

6.4.2.2 Upload Log

NOTE:	This operation can be performed by both internal and external users.

1. Click [Upload Log] on the Maintenance menu.
2. Click [OK], the system performs log uploading automatically. After the uploading is finished, the system will prompt “Upload succeed!”

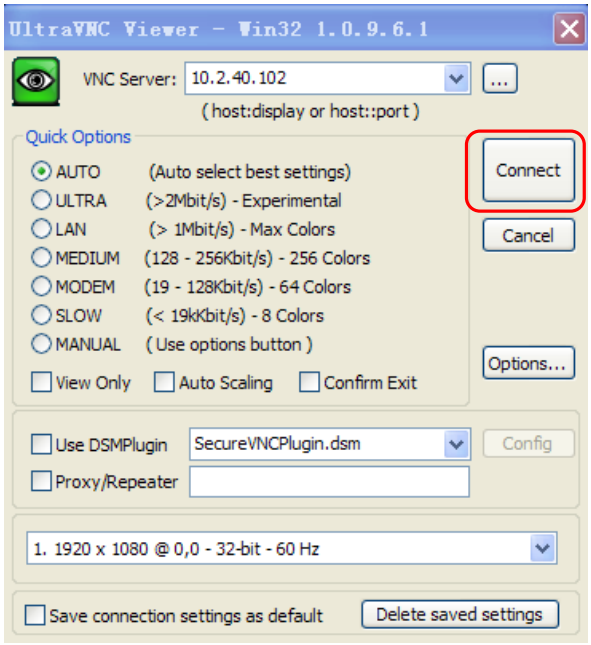
NOTE:	1. Before uploading the log, make sure the ultrasound system has been connected to network; otherwise, the system may warn “could not connect to server”. 2. The server (Smtp.163.com) is already specified by the system, the user doesn’t have to select it.

6.4.3 Remote Desktop

NOTE:	This operation can be performed by both internal and external users.

1. Click [Maintenance] on the Setup menu, then click [Remote Desktop] on the [other] page.

2. Set the password, select whether to “Enable remote control”, click [Run Service] to run the remote desktop service.
3. To access the ultrasound system: run the software vncviewer, input the IP address of the ultrasound system, and click [Connect].



4. After a successful connection, input the password to enter into Doppler system, now the remote user can operate the Doppler system.

NOTE:	During remote desktop, the ultrasound system should be connected to network, and is authorized to use public IP.

6.5 Data Backup and Storage

6.5.1 Manage Settings

Press <Setup> to open the Setup menu, click [Other] to open the Manage Setting interface. System preset can be performed here. Image parameters can be exported, imported or restored to factory.

6.5.1.1 Back up the Preset Data

1. On Manage Settings page, select the preset data to be backed up: “All Preset” or “Image Preset”.
2. Click [Export] to open the [Export Data] dialogue box.
3. Select the path to save data.
4. Click [OK], a progress bar will appear and the preset data of the selected items will be exported to the specified path.

6.5.1.2 Restore the Preset Data

1. On Manage Settings page, select the preset data to be backed up: “All Preset” or “Image Preset”.
2. Click [Import] to open the Import Data dialogue box.
3. Select the path of the preset data.
4. Click [OK], a progress bar will appear and the preset data will be imported to the specified path.

Note: If selecting [Load factory]，it will restore the system to the factory setting, but the [Region],[Admin] and [DICOM Preset] cannot be restored.

6.5.2 Patient Data Backup and Restore

6.5.2.1 Patient Data Backup

1. Press [iStation] on the control panel to open the iStation dialogue box.
2. Click [Select All] to select all the data or select the target data one by one.
3. Select the data, click [Backup] to pop up the Backup patient Record dialogue box, select the target storage device (recorder or USB disk), click [Backup], the data will be backed up.

6.5.2.2 Restore Patient Data

1. Press [iStation] on the control panel to open the iStation dialogue box;
2. Select the drive which contains the patient data, click [Select All] to select all the data or select the target data one by one, click [Restore] to restore the patient data from the current drive to the patient database.

6.6 HDD Partition

◆ The whole capacity is 1TB, the details are shown as follows:

Notes	Blocks(G)	Notes
C:	30G	NTFS
D:	>900G	NTFS
E:	10G	NTFS

◆ Data distribution in each drive is shown as follows:

1. C drive

Catalog		Data	Illustration
C:\DC8	\Image	POD	Probe data (supported probes) system)
		ColorSpectrum	map data, color scale and colorize
	\gui	Font	font file
		Skin	Skin file
		pinyinmap	pinyin data
		Word	input setting data
		LayoutInfo	Layout configuration file
		version.txt	Version file
	\app	bodymark	pictogram
		Report	structured report related data file and DICOM
		obd.bin	report template
		ExamMode	OBD data file
		version.txt	Version file
		Comment	Comment file
		AnatomyImage	Anatomical images
		Measurement	Measurement library
	\exe	main	Doppler program and related boot configuration file and plugins, remote desktop server
		nls	Multilanguage string file
		videoplay	Video play exe file
		Sound	Cine saving and hint sound file
		version.txt	Version file
	\video	Picture	Display testing picture
		version.txt	Version file
	\preset	factory	Factory data
		version.txt	Version file
	\config	Boot_logo.png	Doppler boot-up graphics
		Hospital logo.bmp	Hospital logo
		manu_logo.png	Manufacturer logo
		Real_Image.bmp	Active icon
		Non_Real_Image.bmp	Inactive icon
		Constrst_Probe.bmp	Standby graphics
		Tissue_Probe.bmp	Product configuration file
		Product.PCF	Factory key file
	\Key	Factory.key	Doppler program and related boot configuration

2. D Drive

Catalog		Data	Illustration
D:\DC8	\gui	\word	User-defined word library
	\log	\DcmLog	DICOM log
		\Monitor	Monitor log
		\Operation	Operation log
		\SystemStat	Power on/off log
		\selftest	Self test log
		appmon_window_monitor.txt	Appmon monitor log
		message.txt	Warning message
		PeriLog.txt	Peripheral log
		commentlog.txt	Comment log
		burn_cd_msg.txt	Burn log
		error.txt	System error log
	\PATIENTDATA	\	Main patient database path
	\Preset	\Current	User preset data
	\temporary	\	Temporary file
	\PatientBack	\	Patient back up data

3. E Drive

Catalog		Data	Illustration
E:\DC8	Demo		Ivision default DEMO path
	PatientBack		Patient data back up
	demofile.txt		Ivision default DEMO path

7 Adjustments

7.1 Monitor Adjustment

7.1.1 Position Adjustment

- Height adjustment

  Move the monitor support arm up or down to adjust the height.

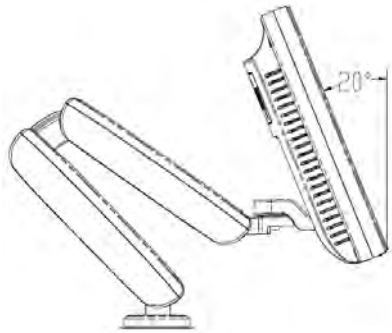
NOTE:	Take care of your hands when adjust the monitor up and down.

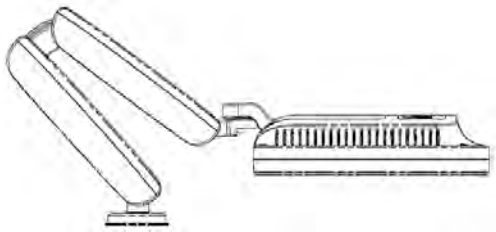
- Rotate the monitor

  The monitor can be rotated ±90° along with the supporting arm; or fix the supporting arm, the monitor can be rotated ±90° alone.

- Tilt the monitor

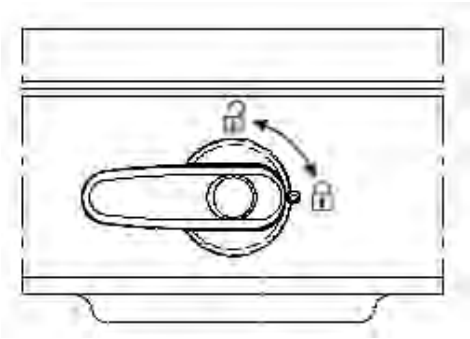
  When positioned vertically, the monitor can be tilted for 20°backward or to the horizontal position forward. In the process of transportation or moving the system, please keep monitor in the horizontal position, shown as follows:





- Lock the monitor

To move the machine, first move the monitor and supporting arm to the middle position, and lock the locking lever to state to avoid crash.



7.1.2 Brightness and Contrast Adjustment

The adjusting buttons are shown as follows:

- Brightness adjustment:

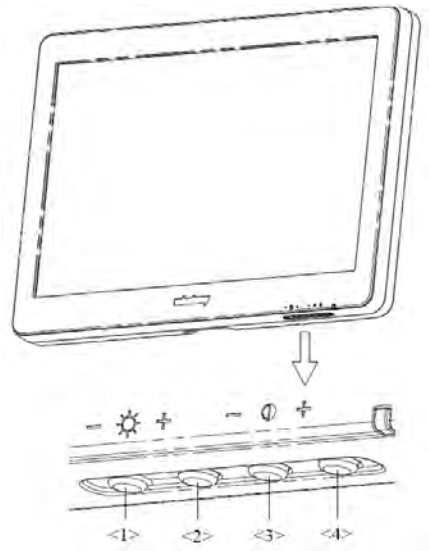
  <1>, <2> refer to the brightness control keys with a sun marked at the top side; key <1>, which marked a "-" on the top side, can be used to decrease the brightness; while key<2>, which marked a "+" on the top side, can be used to increase the brightness.

- Contrast adjustment:

  <3>, <4> refer to the contrast control keys with a lune marked at the top side; key <3>, which marked a "-" on the top side, can be used to decrease the contrast, while key <4>, which marked a "+" on the top side, can be used to increase the contrast.

- Restore the factory default settings

  In [Preset]→[General Preset], click [Brightness/Contrast Load Factory] to restore the values to factory settings.



NOTE:	On the monitor, the brightness adjustment comes before contrast. After readjusting the monitor's contrast and brightness, please adjust all presets.

7.1.3 Monitor Test

1. Log on as the "Service"; refer to chapter 6.1 for details.
2. Press the [F10] key on the keyboard to enter setup menu, and click [Maintenance] to enter the screen.
3. Click [Other] and select [Test Main Monitor] to enter the screen:

No.	Item	Description
1.	Contrast	The screen displays a white strip in the middle while the above and below are black, if the boundary of black and white is clear, the test is passed;
2.	Resolution	Press [Set] to switch between the 2 interfaces, and it's required that the black and white strips in the middle or around are clear, while the adjacent strips can be distinguished to pass the test;
3.	AshRank	Images of different gray rank levels can be distinguished easily with a smooth transition, and the brightness transition can also be obtained from the images. Gray rank of low level is not obviously lean to red or green, and then the test is passed.
4.	ColorRank	Images of different color rank levels can be distinguished easily with a smooth transition, and the brightness transition can also be obtained from the images.
5.	Colorful	If different kinds of color graphics appear on the screen where the color and the word of each graphics are consistent, test is passed.
6.	focus	Press [Set] to switch among the 3 interfaces, if the images are clear with letters and characters easy to be recognized and there is no ambiguous display or variance among them, the test is passed;
7.	BadPoint	Press [Set] to enter pure color interfaces of green, blue, red, black and white. Observe the LCD screen. Check bright point and dark point in the black and

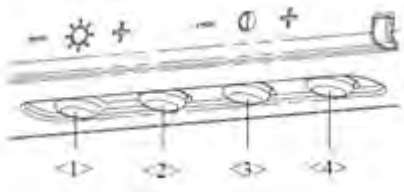
		white interfaces. Criterion for pass: bright point number is 0; number of continuous dark point pair is ≤3, and no continuous dark point appears in the image area; there are no three or more than three continuous dark point; dark point defects number is ≤7, and number of dark points in the image area is ≤2; point flash defects is 0; space between fail points is ≥5mm.

4. Click [Exit] or press [ESC] to return to the main screen interface.

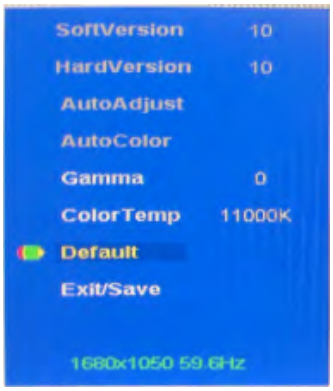
7.1.4 Monitor Parameter Setting

NOTE:	After changing the main monitor, parameter loading should be performed to match the monitor and the system.

The parameters of the main monitor include color temp, brightness/contrast, Gamma, and Default, information of loading Default parameters are introduced here:



1. Press <1> and <4> key on the monitor as shown in the figure for more than 3 seconds to enter the screen.



2. Press <1> or <2> to select Default, the cursor is on the Default position, press <4> to enter the parameter automated loading, and it takes about 3 seconds to finish.
3. Color temperature is default to be 11000K, and adjustment is not recommended.
4. After all settings are finished, move the cursor to Exit or press <3> to exit the menu.

7.2 Touch Screen Adjustment

7.2.1 Touch Screen Brightness and Contrast Adjustment

NOTE:	Avoid operating under direct sunlight, or the touch screen could be blocked. Do not place anything on the touch screen, or the screen view will be blocked.

Open the screen through the path: [Preset]->[Maintenance]->[Other], and click touch screen brightness/contrast menu to perform the adjustment.

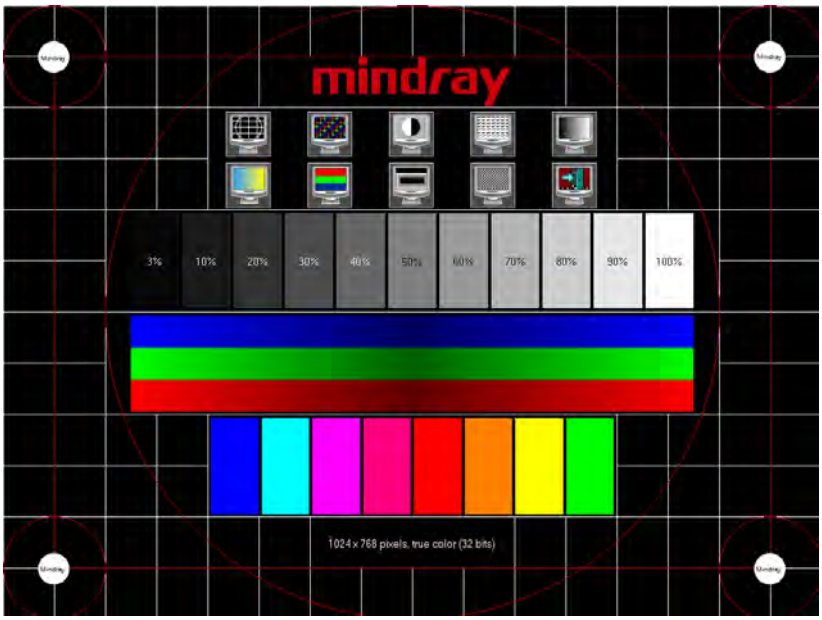
7.2.2 Touch Screen Calibration

Note:	Please calibrate the touch screen after the system software is upgraded or recovered. Or else the touch screen cannot be used normally.

1. Press the [F10] key on the keyboard to enter setup menu, and click [Maintenance]->[Other]->[Touch Calibrate].
2. In the touch screen, click the crosses one by one as per the cursor indication until it prompts that the calibration is done.

7.2.3 Touch Screen Test

1. Log on as the "Service"; refer to chapter 6.1 for details.
2. Press the [F10] key on the keyboard to enter setup menu, and click [Maintenance] to enter the screen.
3. Select [Touch Screen] in the [Other] page to test the touch screen, test methods are the same as in main screen test.



The difference is that in the touch screen test, you should click the touch screen rather than press [Set] in the main screen test; and click the corresponding icon on the touch screen rather than the main screen.

NOTE:	This operation should be performed after the touch screen is calibrated or it may be incorrect.

7.2.4 Touch Screen Setting

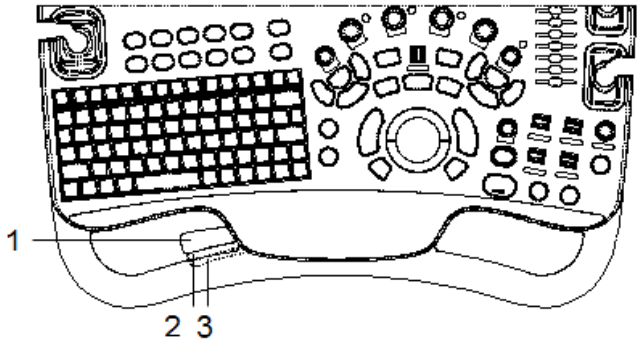
NOTE:	After changing the 10.4inch LCD screen, parameter setting must be performed before using.

1. Press the [F10] key on the keyboard to enter setup menu, and click [Maintenance] to enter the screen.
2. Click [Touch Screen Preset] in the [Other] page to pop up the dialog box, then click “ok” to finish the 10.4inch LCD parameter preset. After that, the LCD screen can be normally used.

7.3 Control Panel Adjustment

◆ Control Panel Position Adjustment

Press the control lever 1 at the side of control panel handle to position 2, the control panel can be rotated 90°; press the lever 1 to position 3, the control panel can be move upwards or downwards (150mm).



◆ Key backlit brightness adjustment

In the [System Preset]→[Key Config] page, you can adjust key backlit brightness and volume.

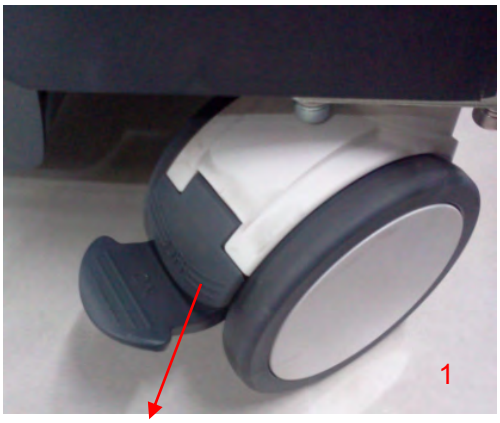
◆ Functional keys setting

In the [System Preset]→[Key Config] page, you can preset functions for keys of print ,save1,save2,F3,F4,F5,F6,F12,P1,P2, for example, you can preset save image to hard drive function of F3.

7.4 Caster Adjustment

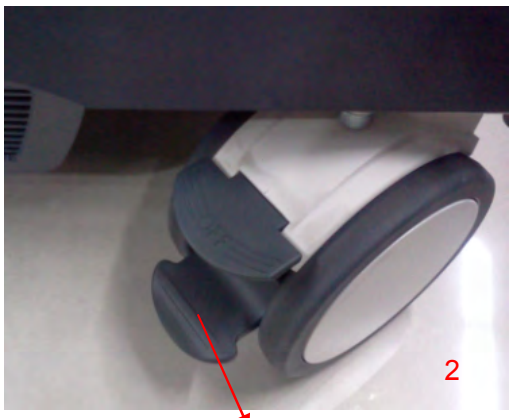
There are four casters of the main unit: 3 break casters and one orientation caster (with the green button), as shown in the figure: tread the 2 “On” button downwards by foot to lock the caster, tread the 1 “Off” button downwards by foot to release the caster. When locking or releasing the casters, move the casters if necessary.

RELEASING



OFF

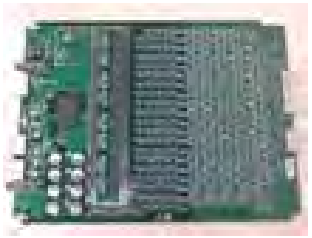
LOCKING

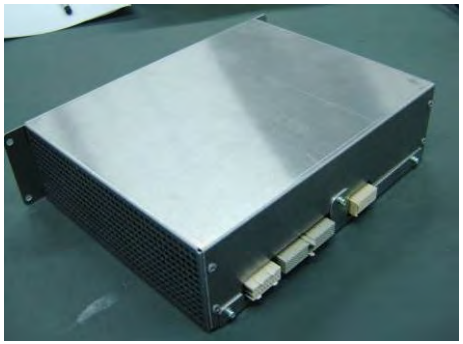


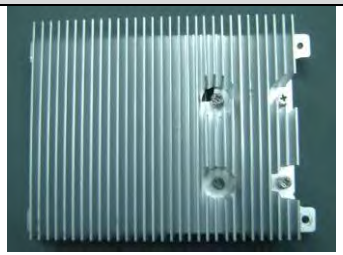
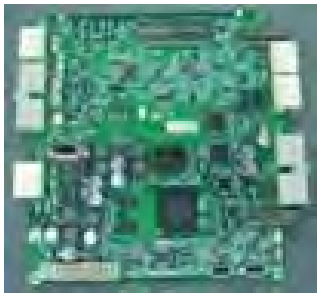
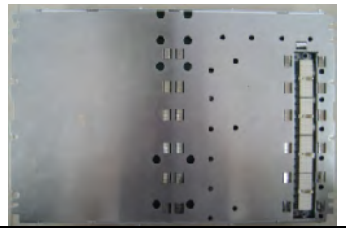
ON

8 Field Replaceable Unit

The detailed information of Field Replaceable Unit is as follows:

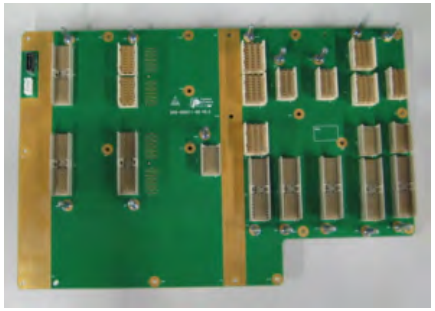
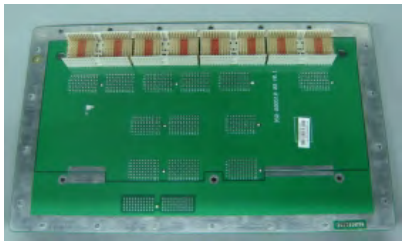
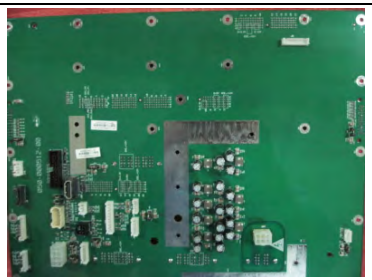
NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
1	DC8 SERIES	Main unit related	Receiving Board (spare part)	801-2120-00007-00		Remark software version	9.3.5
2	DC8 SERIES		Transmission Board (spare part)	801-2120-00008-00		Remark software version	9.3.5
3.0	DC8 SERIES		DSP Board(NO 4D&EI Module) (spare part)	801-2120-00009-00		Not support 4D and elastography	9.3.5

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
3.1	DC8 SERIES		DSP Board(support 4D&EI Module) (spare part)	801-2120-00010-00		Remark software version；4D also need 4DTEE board and dimension probe；Elastography need key.	9.3.5
4	DC8 SERIES		PC assembly (DC-8EXP/Win7/FRU)	115-032578-00		Applied to DC-8 EXP	9.3.6
			PC assembly(Non DC-8EXP/Win7/FRU)	115-032579-00		Applied to DC-8/DC-8 PRO/DC-8 CV/DC-8S	
5	DC8 SERIES		CPU Module(spare part)	801-2120-00030-00		The MAC address will be changed and corresponding optional key need to be made again when replacing HDD.	9.3.6.1

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
							
6	DC8 SERIES		Digital Board Assembly (FRU)	801-2120-00011-00		Remark software version; With button battery. Applied to DC-8/DC-8 PRO/DC-8 CV/DC-8S in XP	9.3.6.1
			Digital Board Assembly(FRU)	115-032384-00		Applied to DC-8/DC-8 PRO/DC-8 CV/DC-8S in Win7	9.3.6.2
			Digital Board Assembly (DC-8 EXP/FRU)	115-027988-00		Applied to DC-8 EXP only	9.3.6.2
6.1	DC8 SERIES		COM module (DC-8 EXP/FRU)	115-028000-00		Applied to DC-8 EXP only. The FRU is concluded with two parts, you need to assembly the fan to the radiator. See section 9.3.6.2 for details.	9.3.6.2
7	DC8 SERIES		Probe Board Assembly (spare part)	801-2120-00034-00		/	9.3.2

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
8	DC8 SERIES		HDD Assembly (spare part)	115-018493-00		DC-8/FDA/XP	9.3.3
				115-018494-00		DC-8/CE/XP	
				115-018495-00		DC-8PRO/CE/XP	
				115-018496-00		DC-8CV/CE/XP	
				115-018497-00		DC-8EXP/CE	
				115-018498-00		DC-8S/CE/XP	
				115-031992-00		DC-8/CE/Win7	
				115-031993-00		DC-8/FDA/Win7	
				115-031994-00		DC-8/Russia &CIS/ Win7	
				115-031995-00		DC-8 PRO/CE/Win7)	
				115-031996-00		DC-8 PRO/ Russia &CIS/ Win7	

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
				115-031997-00		DC-8 CV/CE/Win7	
				115-031998-00		DC-8 CV/ Russia &CIS/ Win7	
				115-031999-00		DC-8S/CE/Win7	
				115-032000-00		DC-8S/Russia &CIS/Win7	
				115-032001-00		DC-8 EXP/FDA/Win7	
				115-032396-00		DC-8/India/Win7	
				115-032397-00		DC-8 PRO /India/Win7	
				115-032398-00		DC-8 CV/India/Win7	
				115-032399-00		DC-8 S /India/Win7	
				115-032400-00		DC-8 EXP/India/Win7	
9	DC8 SERIES		IO BOX Board(spare part)	801-2120-00001-00		No WiFi and antenna.	9.3.4

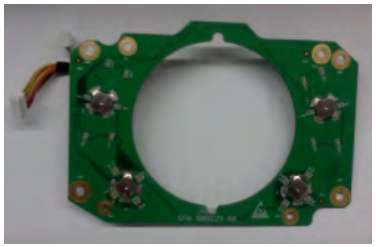
NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
10	DC8 SERIES		Communication mother board assembly (spare part)	801-2120-00002-00		/	9.3.5
11	DC8 SERIES		Front-end analog mother board	051-000650-00		/	
12	DC8 SERIES		Back-end mother board	051-000652-00		/	

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
13	DC8 SERIES		Front Cover USB connecting board	051-000655-00		Only two USB ports	
14	DC8 SERIES	Power related	2120 Connecting Board (spare part）	801-2120-00012-00		Support AC 220V	9.3.1
15	DC8 SERIES		2120 AC-DC Assembly(spare part)	801-2120-00006-00		With cover	9.3.8
16	DC8 SERIES		2120 Back-end Power Board (spare part)	801-2120-00005-00		Remark software version	9.3.7.2

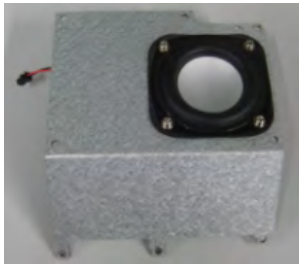
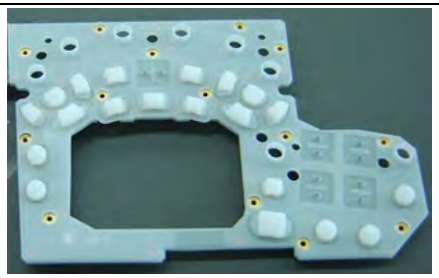
NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
17	DC8 SERIES		2120 Front-end Power Main Board (spare part)	801-2120-00003-00		Remark software version	9.3.7.3
18	DC8 SERIES		2120 Front-end Power Auxiliary Board (spare part)	801-2120-00004-00		/	9.3.7.1
19	DC8 SERIES	Control panel related	Top Cover of Keyboard Assembly (spare part)	801-2120-00015-00		Except Trackball, TCG, Digital key-board, two encoders and Master panel six in one encoder Assembly Applied to DC-8/DC-8 PRO/DC-8 CV.	9.3.9
				115-027985-00		Except Trackball, TCG, Digital key-board, two encoders and Master panel six in one encoder Assembly Applied to DC-8 EXP only.	

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
19.1	DC8 SERIES		Minor panel assembly	043-001928-01		Applied to DC-8 EXP only.	9.3.11
19.2	DC8 SERIES		EXP control panel top cover	043-001530-01		DC-8 EXP	9.3.9
20	DC8 SERIES		Digital Key-board module (spare part)	801-2120-00017-00		Remark software version Applied to DC-8/DC-8 PRO/DC-8 CV/DC-8S.	9.3.9.6
20.1	DC8 SERIES		Digital Key-board module (DC-8 EXP/ RU/ FRU)	115-027987-00		Remark software version Applied to DC-8 EXP Russian version only.	9.3.9.7

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
20.2	DC8 SERIES		Digital Key-board module (DC-8 EXP/FRU)	115-027986-00		Remark software version Applied to DC-8 EXP version only.	9.3.9.7
21	DC8 SERIES		Master panel six in one encoder Assembly (spare part)	801-2120-00018-00		With cable and cap	9.3.9.1
22	DC8 SERIES		NAVI-Encoder Assembly (spare part)	801-2120-00019-00		With cable and cap	9.3.9.3
23	DC8 SERIES		ZOOM Encoder Assembly (spare part)	801-2120-00020-00		With cable and cap	9.3.9.2

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
24	DC8 SERIES		TGC Assembly (spare part)	801-2120-00021-00		With cable and cap	9.3.9.4
25	DC8 SERIES		Trackball Assembly (spare part)	801-2120-00022-00		With cable	9.3.9.5
26	DC8 SERIES		Trackball key board	051-000669-01		/	

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
27	DC8 SERIES		10.4 Inch Monitor Assembly (spare part)	801-2120-00024-00		/	9.3.11.1
28	DC8 SERIES		Touch Screen Assembly (spare part)	801-2120-00025-00	+	No soft underlay	9.3.11.3
29	DC8 SERIES		Minor Control Key Board Assembly (spare part)	801-2120-00026-00		/	9.3.11.5
30	DC8 SERIES		Minor Control six in one encoder Assembly (spare part)	801-2120-00027-00		/	9.3.11.4

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
31	DC8 SERIES		Signal Speaker assembly (spare part)	801-2120-00033-00		/	9.3.12.3
32	DC8 SERIES		USB adapter board on control panel	051-000668-00		/	
33	DC8 SERIES		Control Panel Silica Key	049-000227-00		/	
34	DC8 SERIES		Left Silica Key	049-000228-00		On the left side of trackball when facing to the machine.	

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
35	DC8 SERIES		Right Silica Key	049-000229-00		On the right side of trackball when facing to the machine.	
36	DC8 SERIES		Control Panel Silica Key 1	049-000233-00		/	
37	DC8 SERIES		Power Silica Key	049-000277-00		Under the power button.	9.3.11.5
38	DC8 SERIES		Buzzer Connecting Cable	TSB1-21-20440		/	

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
39	DC8 SERIES	Monitor	Monitor Assembly (spare part)	801-2120-00023-00		/	9.3.10
40	DC8 SERIES		Front cover assembly of the monitor(spare part)	115-023114-00		/	9.3.12.2
41	DC8 SERIES	Fan related	Small fans assembly(spare part)	801-2120-00031-00		One group（2 PCS）	9.3.12.1
42	DC8 SERIES		Big fans assembly (spare part)	801-2120-00032-00		One group（2 PCS）	9.3.12.1

NO.	Model	Classification	Description	Order Number	Photo	Compatibility	Assembly/ Disassembly
43	DC8 SERIES	Accessories case	Endocavity probe holder	043-001433-00		/	
44	DC8 SERIES		Pencil probe holder	043-001434-00		/	
45	DC8 SERIES		Probe holder (deep)	043-001435-00		/	
46	DC8 SERIES		Probe holder (small & shallow)	043-001437-00		/	
47	DC8 SERIES		Touch pen (mould MR62422)	0104-20-62422		/	
48	DC8 SERIES	Others	DVD-R/W (with SATA port and white cover)	023-000275-00		/	9.3.12.2

9 Structure and Assembly/Disassembly

9.1 Structure of the Whole System

9.2 Preparation

9.2.1 Tools Required

Cross-headed screwdriver : One，specification: 105X100
Anti-static gloves: one pair

9.2.2 Requirement for Engineers

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform assembly and disassembly.

9.2.3 Assembly/Disassembly Requirements

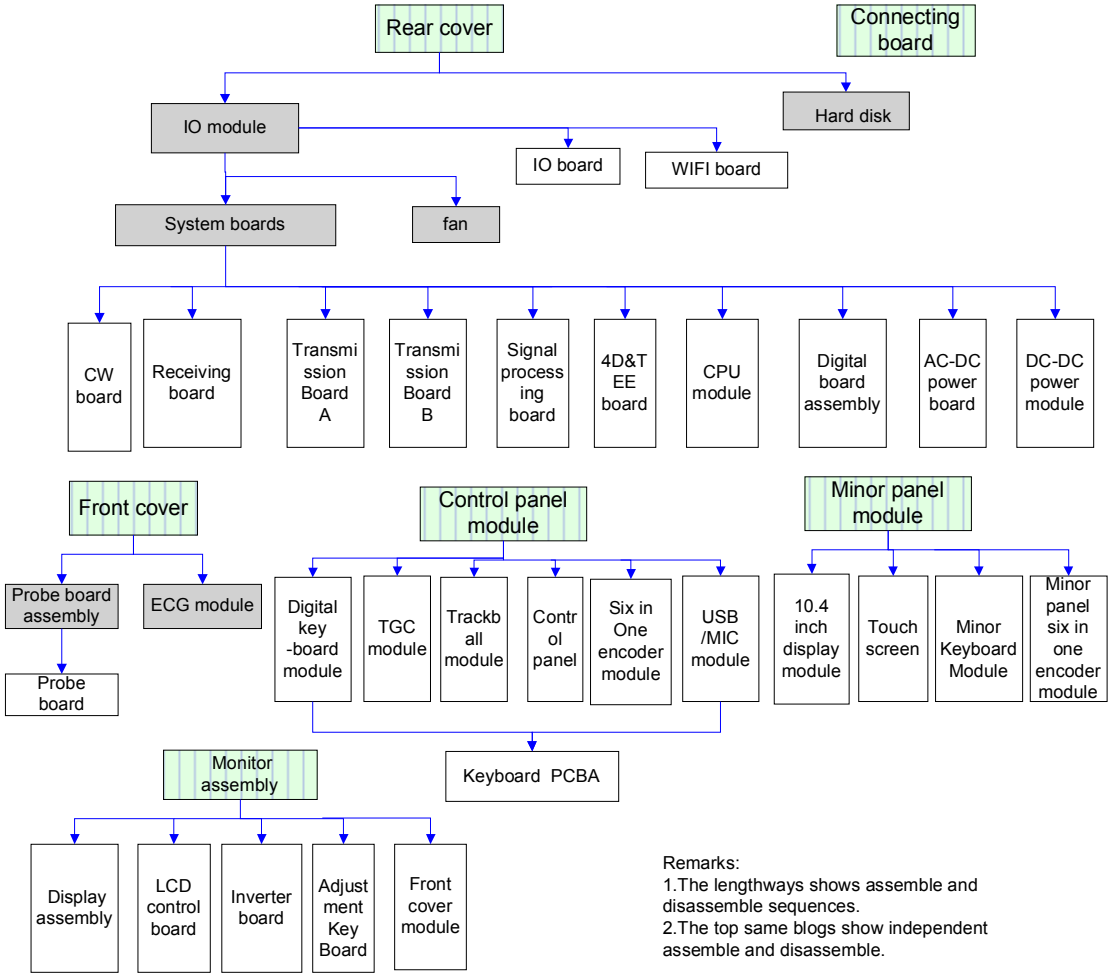
You should make the following preparations before disassembling of ultrasound equipment.

1. When you stop scanning and capturing image, you should power off the system and disconnect the system from the AC power supply, then pull out AC power cable.
2. Lock the casters to prevent accidental movement during assembly and disassembly.
3. Prepare the tools.

9.3 Assembly and Disassembly

This section describes the disassembling and assembling of the main assemblies and boards. Assembly procedure is inverse with disassembly procedure if no special explanation

- **Disassembling scheme**

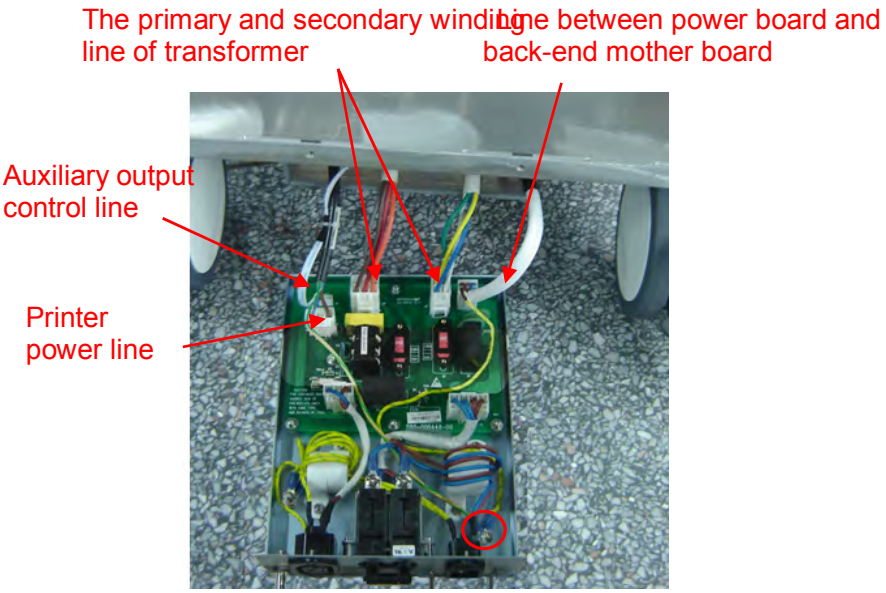


NOTE:	Figures below are for reference. Please take actual equipment as a standard.

9.3.1 Connecting Board

1. Unscrew the M4x8 screws (2 pcs) fixing the power input assembly.

Hold the buckles of power wire and pull out power input assembly in the horizontal direction. Remove one screw and four plugs of cable as follows, and then power input module could be removed.


The primary and secondary winding line of transformer
Line between power board and back-end mother board
Auxiliary output control line
Printer power line

9.3.2 Remove Probe Board Assembly

1. Hold the position as marked in the below figure by index finger and move it outward to remove covers of the printer and the storage box.

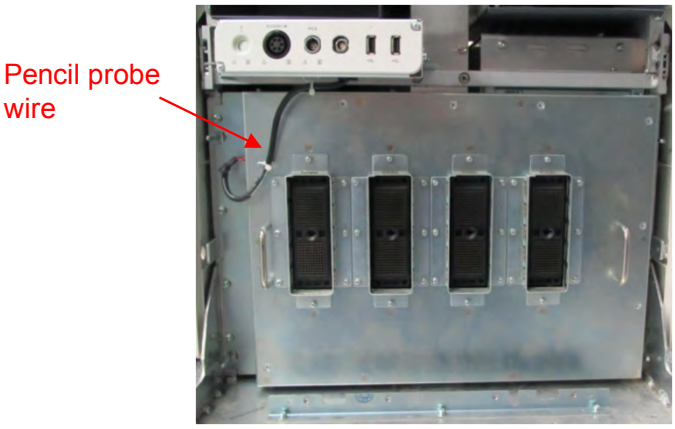
2. Remove 2 M4×8 screws which are fixed on the base of main unit rack below the footswitch board.

3. Pull out the footswitch board module in the direction. marked below

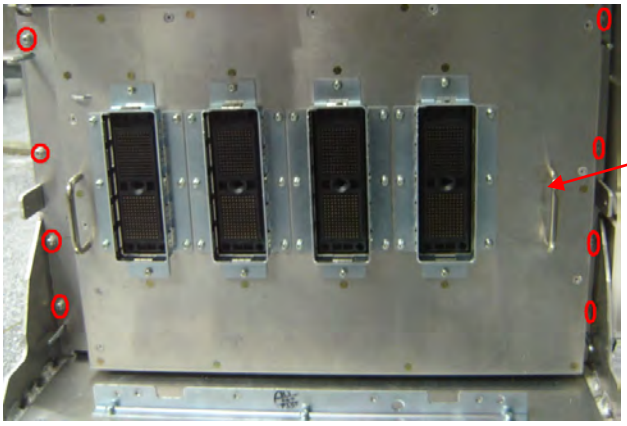
4. Pull out the plugs (t2 pcs at each side) that are filled in the left and right lateral sides, and then remove the M4X8 screws (2 pcs at each side) which are installed on the rack of two sides. .

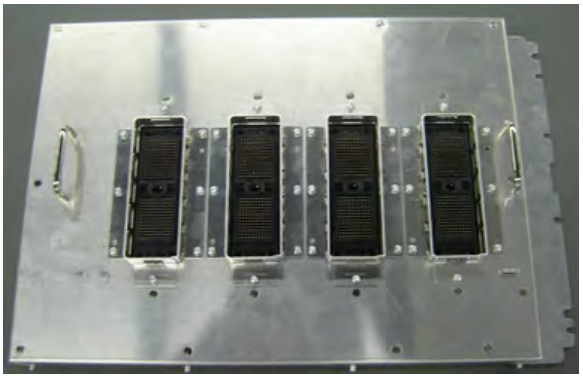
5. Remove the 4 M4X8 screws which are used to secure the rack below the main unit cover, remove the cover downward slightly and take off the frontal cover when the cover is separated from the slot at the top side.

6. Cut the connection wire tie of ECG pencil probe and pull out the port of the pencil probe from probe board.



7. Unscrew 8 M4X12 screws fixing probe board assembly and pull it out.





9.3.3 Hard Disk Assembly

NOTE Please pay attention to the following matters during disassembling/assembling, otherwise the hard disk will be damaged:

- Hold the side of the hard disk, and please do not touch the board of the hard disk.
- Fasten the screws with the handy screw driver, and do not with the electric screw driver.
- The torsion value of the screw lock is:

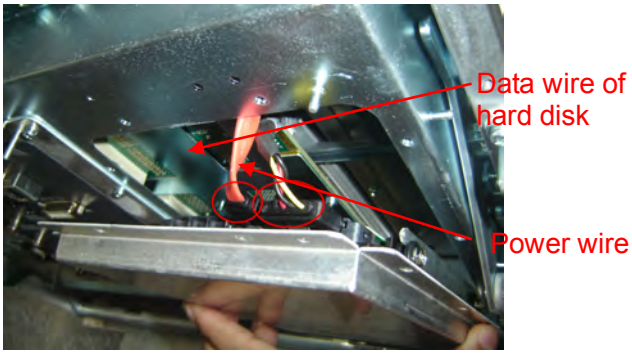
  M3: 4 to 6 kgf.cm

  M4: 6 to 8 kgf.cm

1. Pull out the plugs (three at each side) that are filled in the left and right lateral sides and one in the middle, and then remove the M4X8 screws (three at each side and one in the middle).

2. Hold the bottom of the rear cover to remove it outwards.
3. Remove ten M3X8 screws, and take off the hard disk assembly.

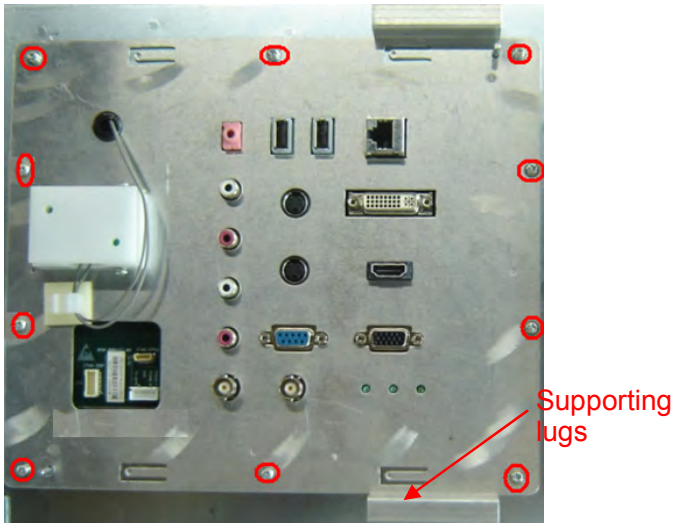
4. As shown in the figure, disconnect the data wire and power wire of hard disk from the hard disk connecting board to remove the hard disk assembly.



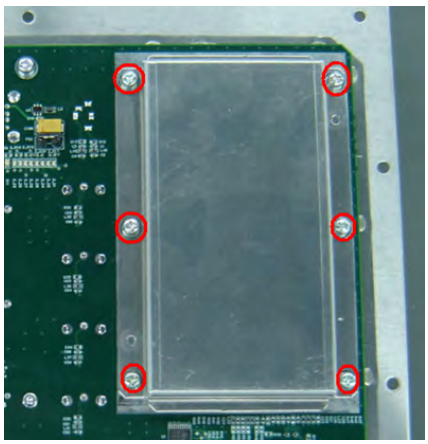
NOTE:	The length of hard disk data wire is limited, please pay attention when take it out to prevent from damaging the linker of hard disk.

9.3.4 IO BOX Board and WIFI PCBA

1. Remove the rear cover. Refer to procedure 1 and 2 in 9.3.3.
2. Remove ten M3X8 screws and hold the two supporting lugs to pull out the IO BOX board module.



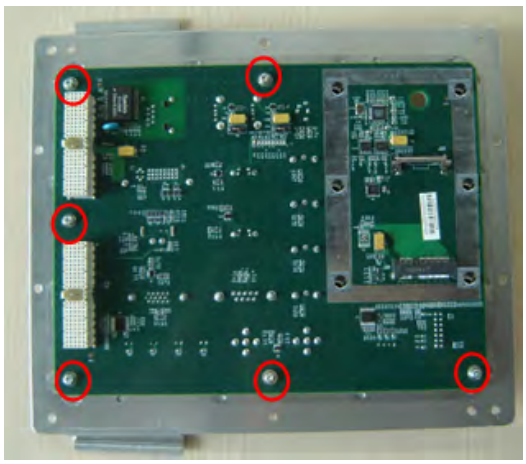
3. Unscrew the M3X8 screws (6 pcs) securing the WIFI PCB shielding cover, and then remove the cover.



4. Remove the WIFI antenna in vertical direction by acting on the metal plug.

5. As shown in the figure, release two elastic sheets fixing WIFI PCBA to remove it.

6. Unscrew six M3X8 screws fixing IO board to remove IO BOX board.



9.3.5 CW Board, Transmission Board, Receiving Board, Signal Processing Board and 4D or 4D&TEE board

1. Remove the rear cover. Refer to procedure 1 and 2 in 9.3.3.

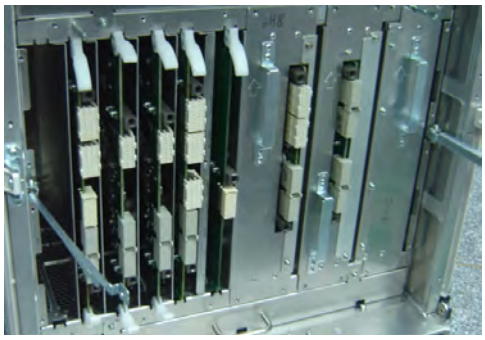
2. Unscrew 2 M3X8 screws fixing the big handle.

3. Unscrew 26 M3X8 screws fixing Communication Mother Board Assembly.

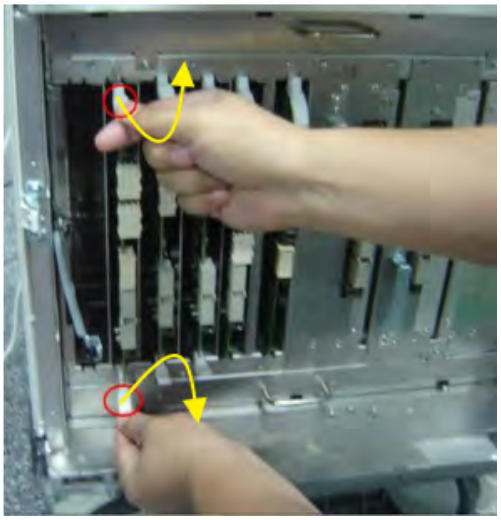
4. Pull upwards the handle and remove the Communication Mother board Assembly from the main unit box.

5. Hold the handle and pull out the Communication Mother Board Assembly.

6. After removing Communication Mother Board Assembly, as shown in the figure, unscrew one M3X8 screw and open the board retainer.



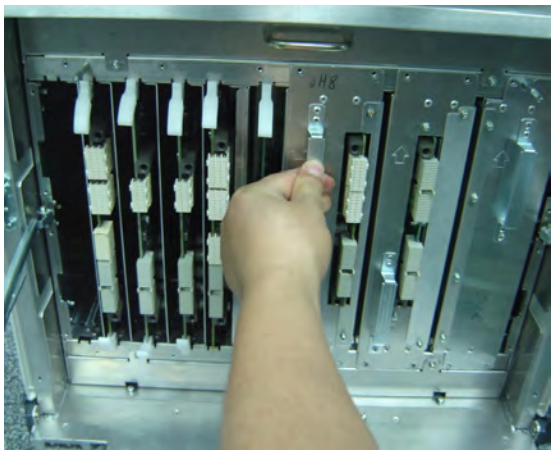
7. As shown in the figure, there are two plastic detachers, release them outwards to a certain position, the board will be released automatically and then take the board out.



8. Disassemblies of boards are all the same. As shown in the figure, from left to right, they are CW board, receiving board, transmission board (1), transmission board (2), signal processing board and 4D or 4D&TEE board.
9. Insert the board into the certain position along the slot and release the locker to lock the board.

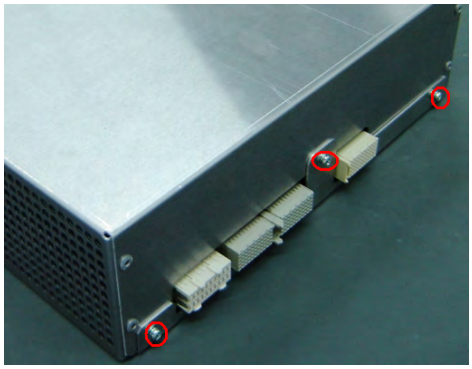
9.3.6 PC Module Assembly

1. Refer to procedure 1 to 6 in 9.3.5.
2. As shown in the figure, hold the metal handle and pull it outwards to remove the PC module assembly.

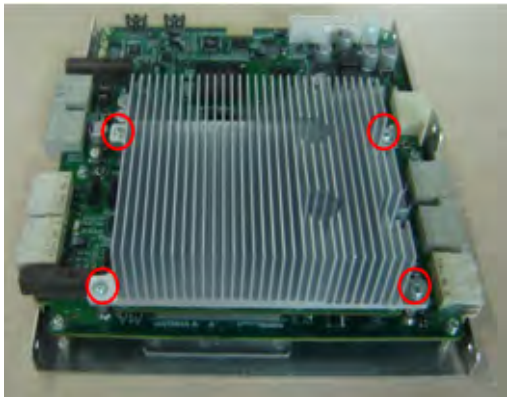


9.3.6.1 Digital Board Assembly (XP)

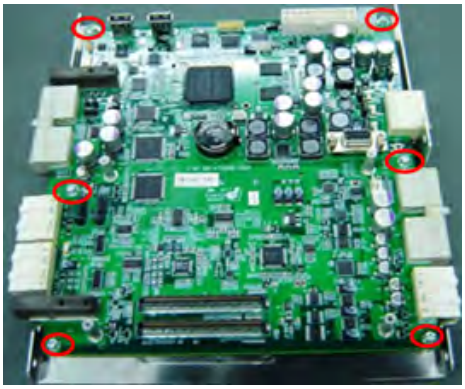
1. Take the PC module assembly out and unscrew five M3X8 screws to open the top cover.



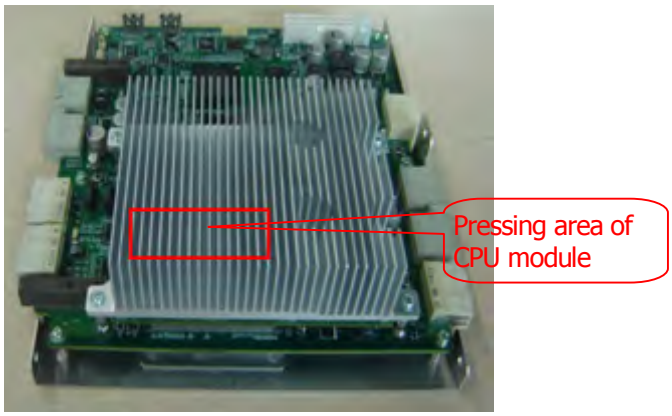
2. Remove the top cover and unscrew four M3X8 screws fixing CPU module to remove CPU module.



3. As shown in the figure, unscrew six M3X8 screws to remove the digital board assembly.

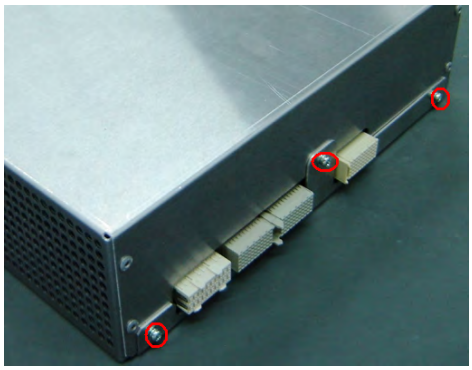


NOTE:	When assembling, put CPU module on the digital board and move it gently to insert the plug of CPU into the socket of the digital board. And then press the radiator moderately to make the plug and socket connect with each other fully.

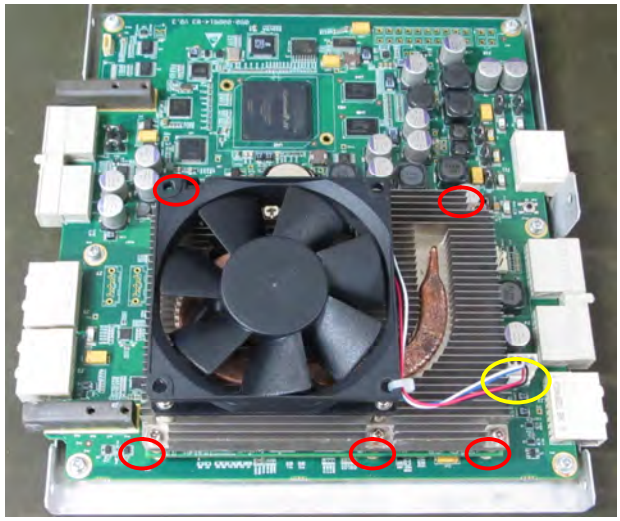


9.3.6.2 Digital Board Assembly and COME module assembly (Win7)

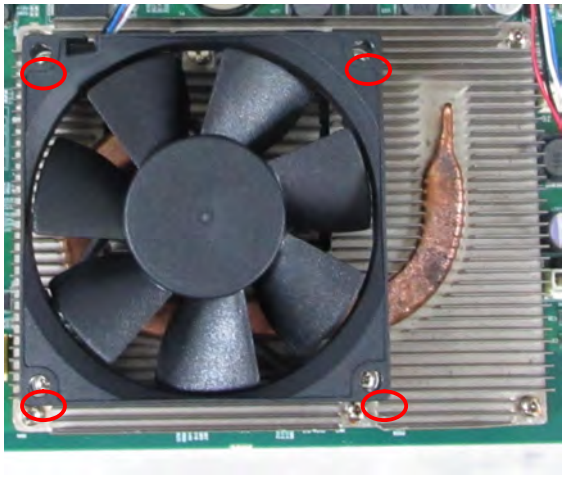
1. Take the PC module assembly out and unscrew five M3X8 screws to open the top cover.



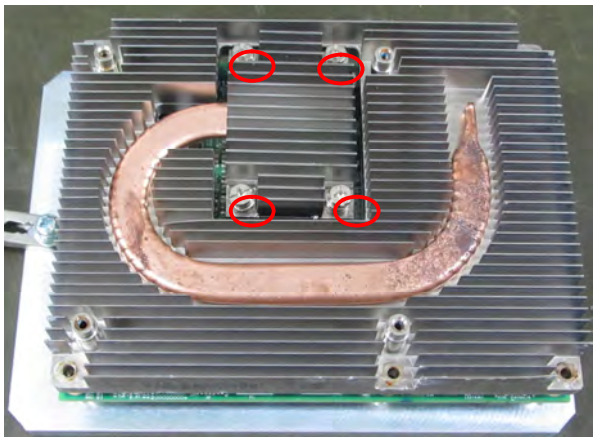
2. Remove the top cover and unscrew four M3X8 screws fixing COME module (CPU board + radiator) and then pull out the fan connecting cable to remove COME module.



3. Remove the four fan-fixing M3X8 screws to see the fixing screws between radiator and CPU board;

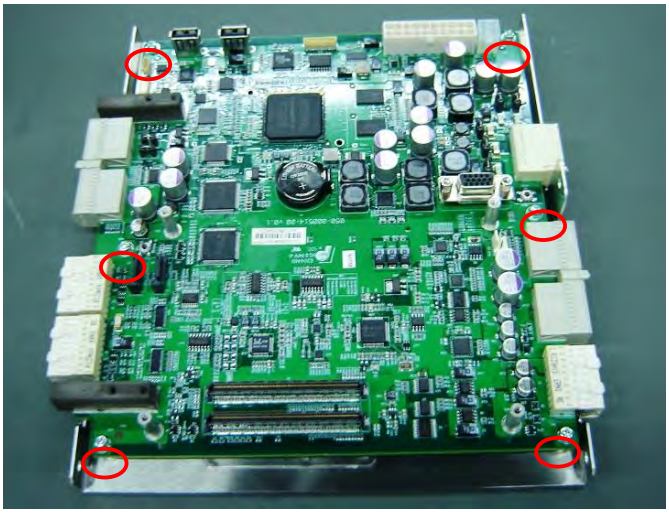


4. Loose the spring screw between the radiator and CPU board to take off the radiator so that CPU board can be removed.

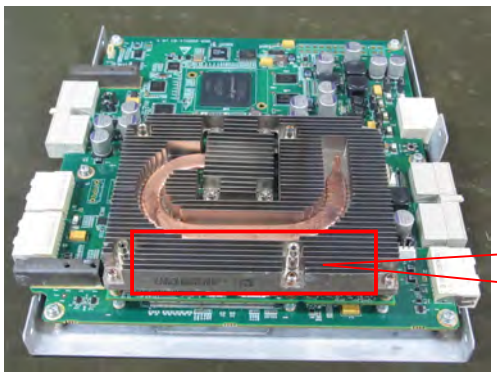


5. When the COME module is disassembled from the digital board, remove six M3X8 screws for fixing digital board assembly to remove the digital assembly.

Note: there are 5 D-type studs on the digital board, you need to remove the those 5 studs from the old digital board to the replaced one.

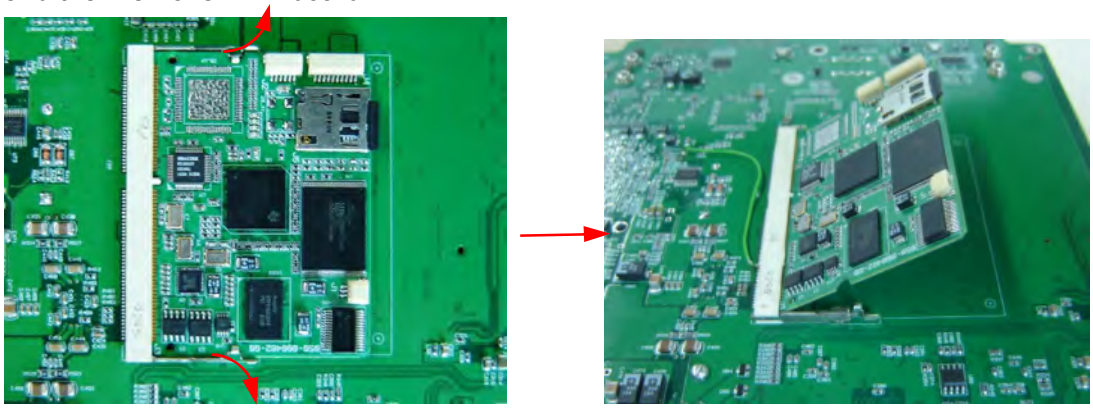


NOTE:	When assembling COME module to the digital board, please take the following sequence: first assemble the radiator to the CPU board and then assemble the COME module to the digital board, the fan assembly comes last to prevent the fan from damage. Align the COME module to the board connector and slightly change the position to allow the CPU board connector connects the digital board connector, and then push the radiator moderately to make the plug and socket connect with each other fully.



9.3.6.3 DVR Board

Put the digital board assembly with button cell downwards and release DVR board retainer, and then remove DVR board.

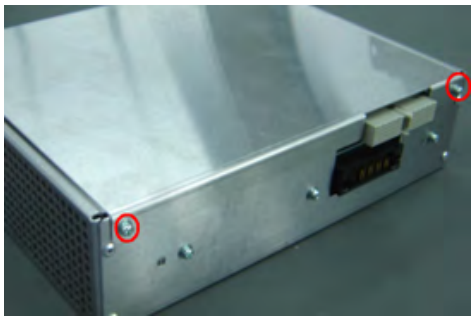


9.3.7 DC-DC Power Module

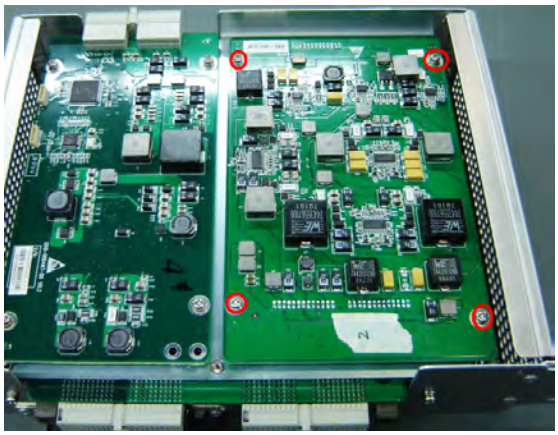
1. Refer to procedure 1 to 6 in 9.3.5.
2. Hold metal handle and pull it outwards to remove DC-DC power module.

9.3.7.1 Front-end Power Assistant Board

1. As shown in the figure below, unscrew four M3X8 screws fixing the top cover of DC-DC power module to remove it.

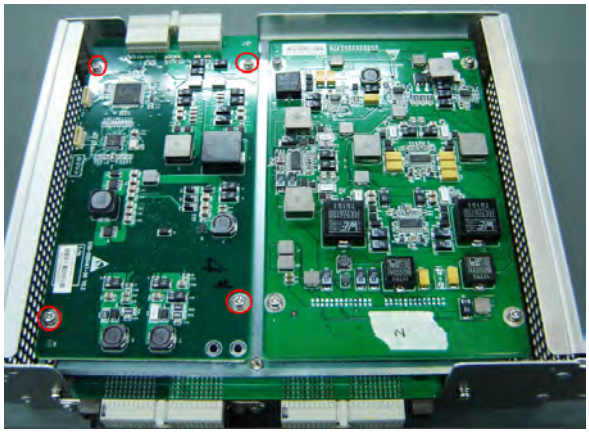


2. Unscrew four M3X8 screws to remove the front-end power assistant board.



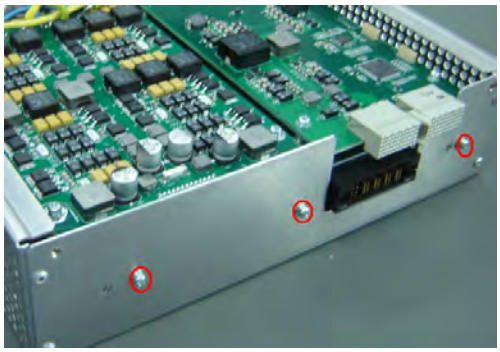
9.3.7.2 Back-End Power Board

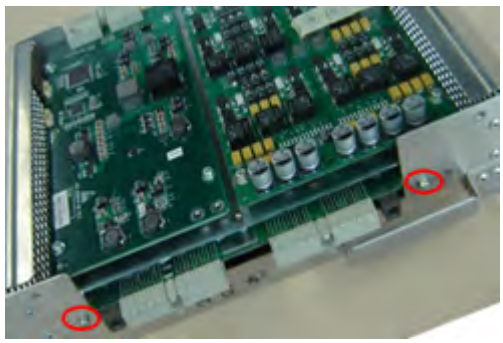
1. As shown in the figure below, unscrew four M3X8 screws to remove the back end power board.



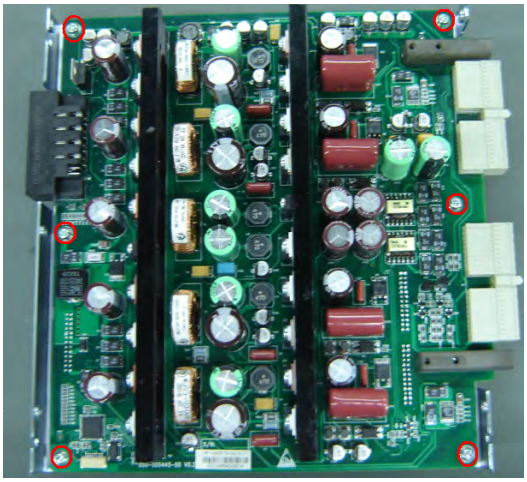
9.3.7.3 Front-end Power Main Board

1. Refer to procedure 1 in 9.3.7.1.
2. Unscrew five M3X8 screws to remove the front-end power board module.





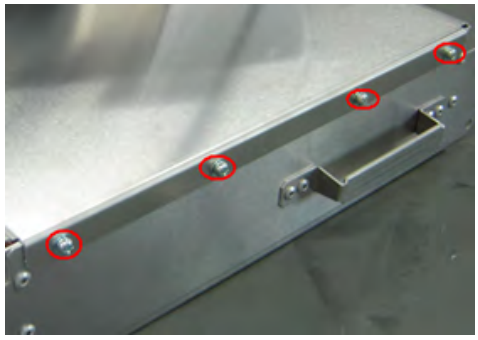
3. Unscrew six M3X8 screws to remove the front-end power board from the separating board.



9.3.8 AC-DC Power Board

1. Refer to procedure 1 to 6 in 9.3.5.
2. As shown in the figure below, hold the metal handle and pull AC-DC power module outwards.

3. As shown in the figure below, unscrew eight M3X8 screws to remove the top cover of AC-DC power module.



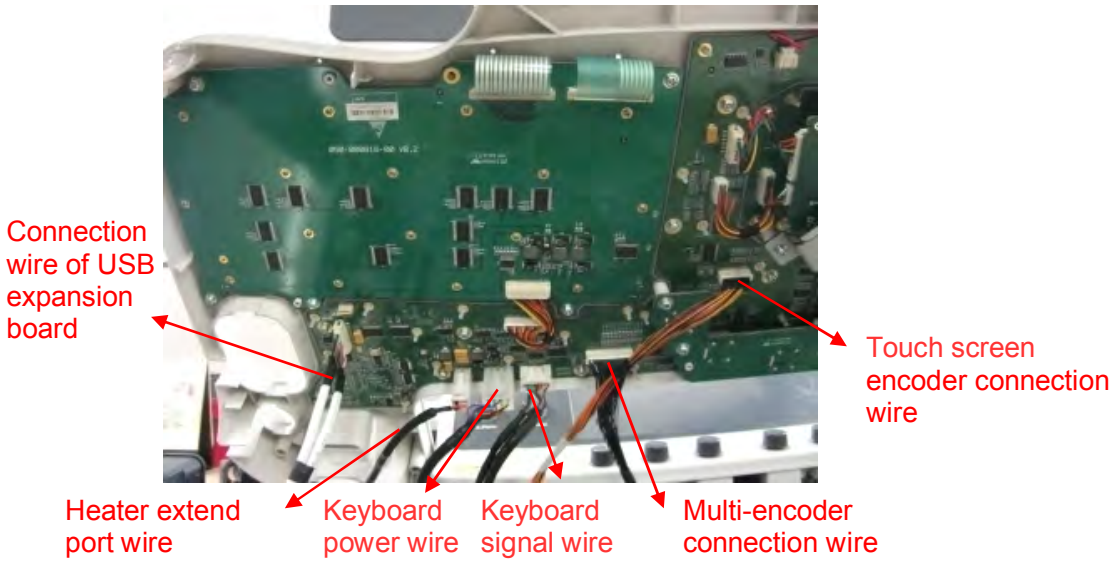
4. Unscrew five M3X8 screws to remove the AC-DC power board.

9.3.9 Control Panel Assembly

1. From bottom to top, unscrew ten M4X8 cross panhead screws of control panel base.

2. Lift control panel assembly from the handle and then unscrew two M3X8 cross panhead earth screws.

3. Lift the control panel module to the position shown in the figure below, and then disconnect six plugs to remove control panel assembly.


Connection wire of USB expansion board
Touch screen encoder connection wire
Heater extend port wire
Keyboard power wire
Keyboard signal wire
Multi-encoder connection wire

The operations from 9.3.9.1 to 9.3.9.8 can be done in the modules disassembled.

9.3.9.1 Master panel Six in One Encoder Assembly

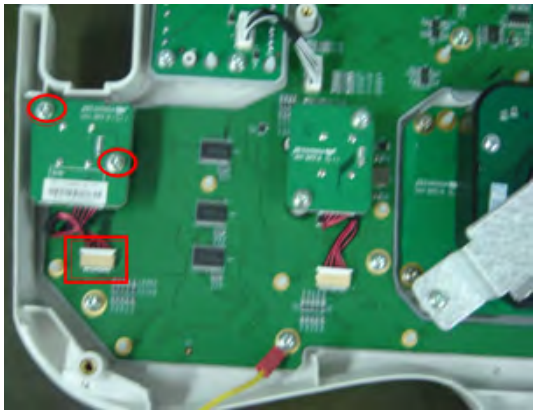
1. Pull out six covers of the encoders.

2. Unscrew five M3X8 screws on master panel six in one encoder and pull out signal wire of encoder to remove the assembly.

9.3.9.2 ZOOM Encoder assembly

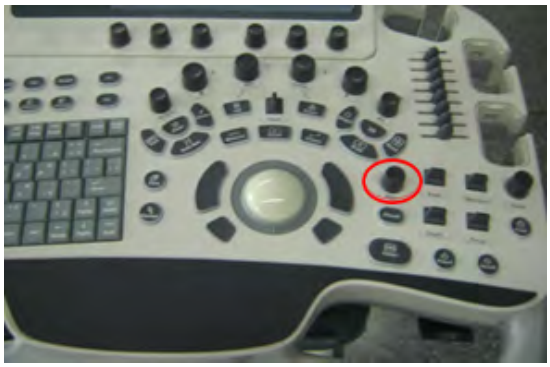
1. Pull out the cover of ZOOM encoder.

2. Pull out the signal wire of encoder as shown in the figure and unscrew two M3X8 screws to remove ZOOM encoder assembly.



9.3.9.3 NAVI Encoder Assembly

1. Pull out the cover of NAVI encoder.

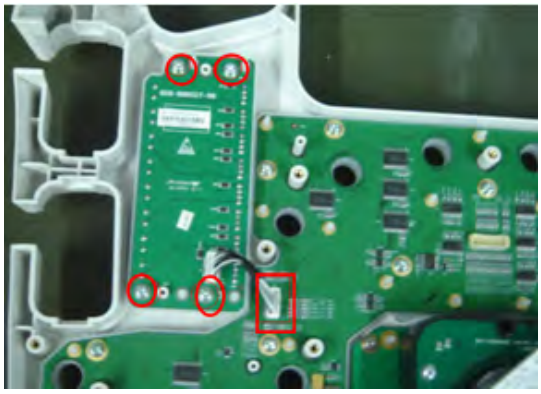


2. Disconnect and remove signal wire of encoder as shown in the figure and unscrew two M3X8 screws to remove NAVI encoder assembly.

9.3.9.4 TGC Assembly

1. Pull out eight covers as shown in the figure.

2. Disconnect and remove signal wire of TGC signal board and unscrew four M3X8 screws as shown in the figure to remove TGC assembly.



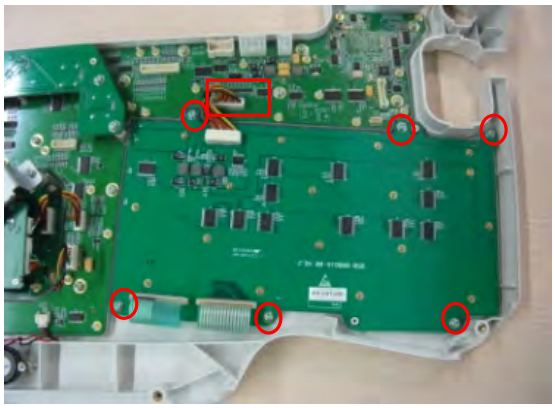
9.3.9.5 Trackball Assembly

Pull out the connection wire of trackball and unscrew two M3X8 screws as shown in the figure and take out the fixing piece to remove trackball assembly.

9.3.9.6 Digital Keyboard Module (for XP)

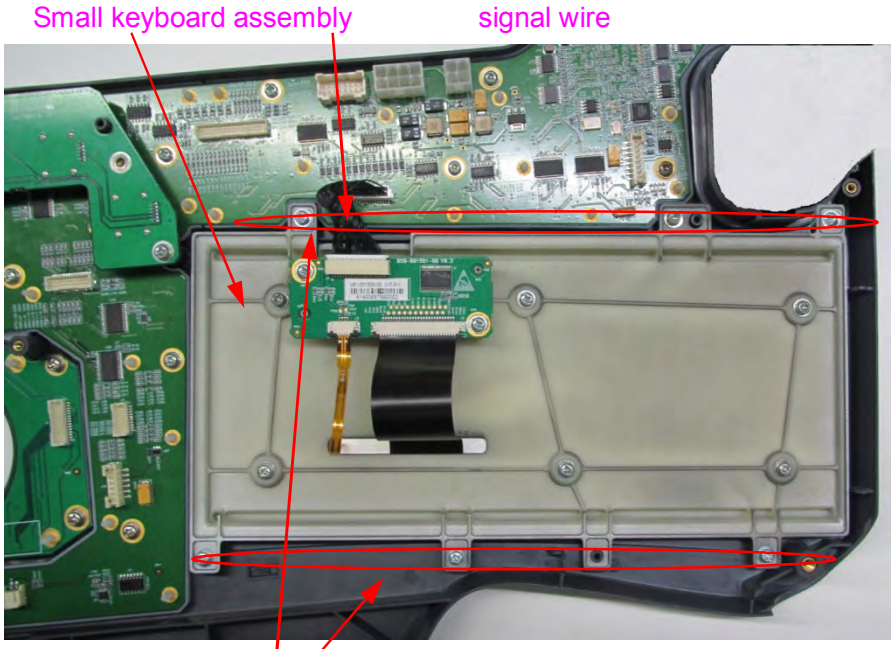
1. As shown in the figure, unscrew one M3X8 screw to remove the fixed piece of control panel.

2. Pull out signal wire of small keyboard and unscrew six M3X8 screws to remove digital keyboard module.



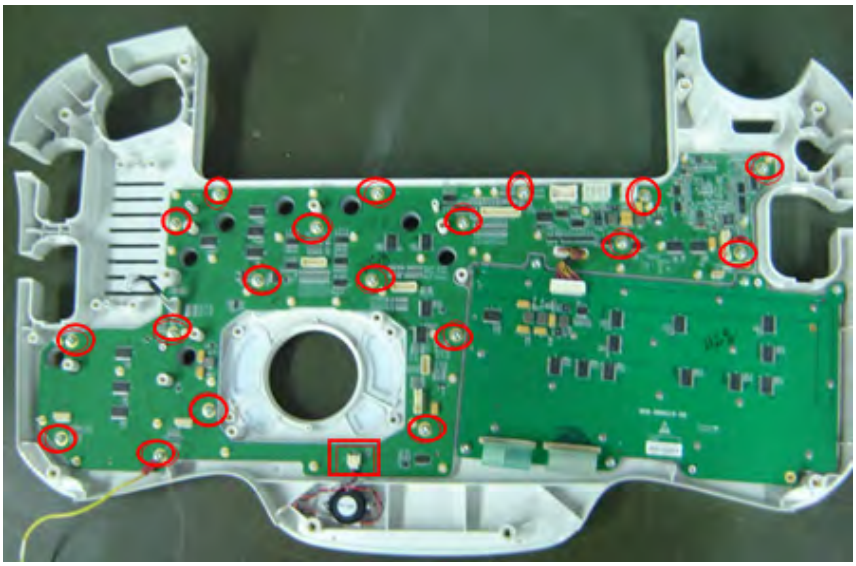
9.3.9.7 Digital Keyboard Module (for Win7)

1. Remove the fixed piece of control panel, see step 1 in 9.3.9.6 chapter.
2. Pull out signal wire of small keyboard and unscrew six M3X8 screws to remove digital keyboard module.



9.3.9.8 Keyboard Board and Silicon Key/1 of Main Control Keyboard

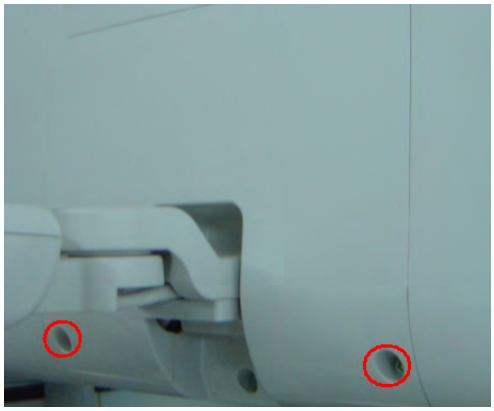
1. Remove master panel six in one encoder module, zoom encoder module, NAVI encoder module, TGC module and trackball module.
2. Pull out buzzer wire and unscrew nineteen M3X8 screws to remove keyboard board and silicon key of main control keyboard.



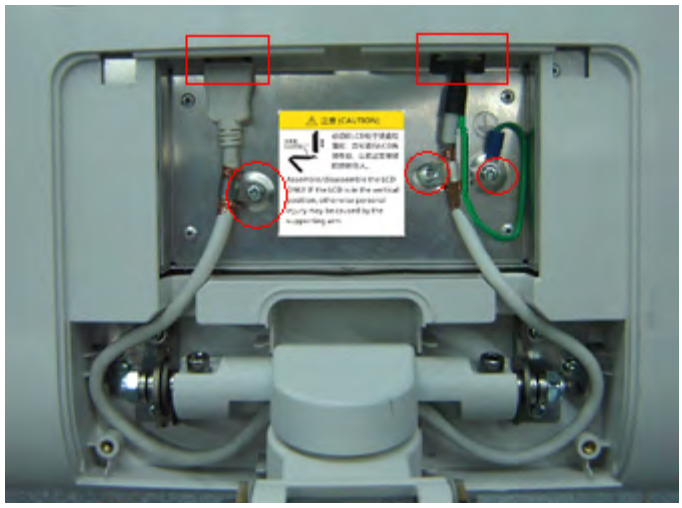
9.3.10 Monitor Assembly

NOTE:	Parameters must be reloaded after changing monitor assembly. Monitor can be normally used only after the matching of machine and monitor. Refer to 7.1.4 for details.

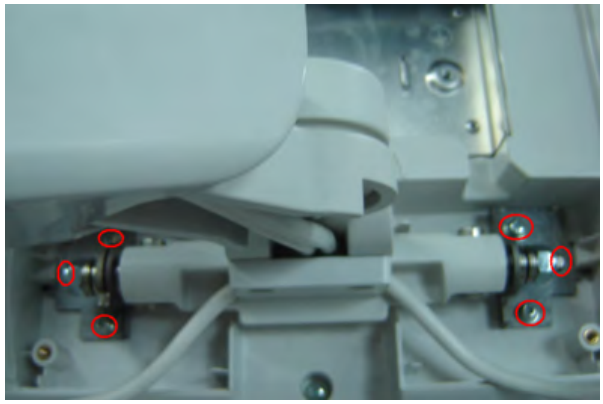
1. Adjust the monitor to the upright position and fix it. Unscrew two M4X12 screws, remove the rear cover.



2. Unscrew three M4X8 screws to remove signal cable of monitor and power wire.



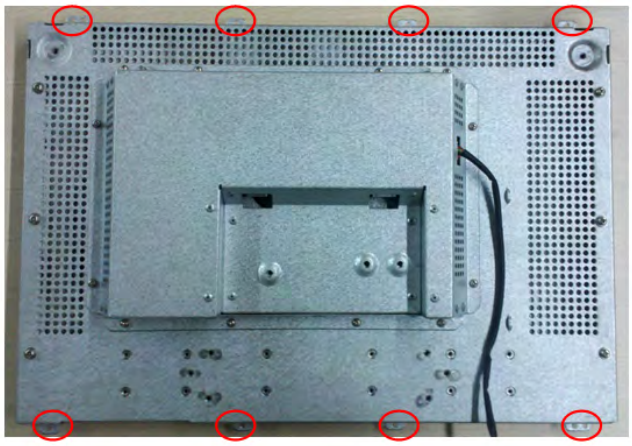
3. Adjust the display to the upright position and fix it. Unscrew six M4X12 screws to remove monitor assembly.



9.3.10.1 Monitor Assembly\Front Cover Assembly\ Back Cover

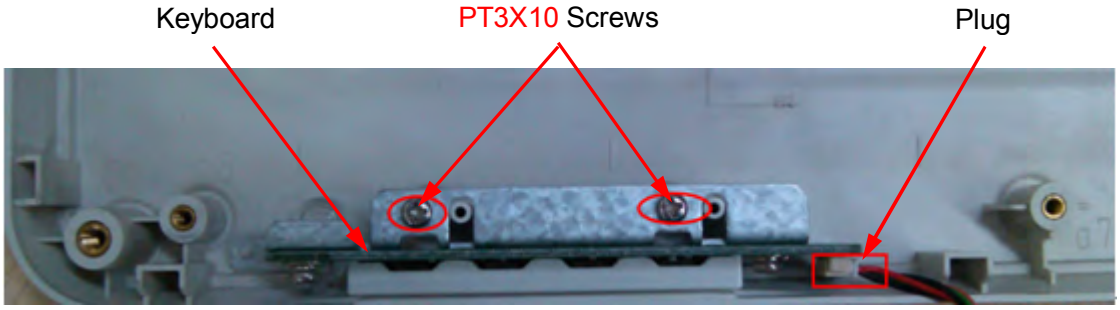
1. Remove the monitor assembly (referring to 9.3.10);
2. Unscrew five M4X12 fastening screws and remove the back cover.

3. Unscrew eight M4X12 screws to remove monitor assembly. Pull out the plug of front cover assembly, the left part is front cover assembly.



9.3.10.2 Replace Front Cover Assembly

1. Remove front cover assembly, refer to chapter 9.3.10.1;
2. Insert the plug of monitor assembly to the keyboard of the new front cover assembly.

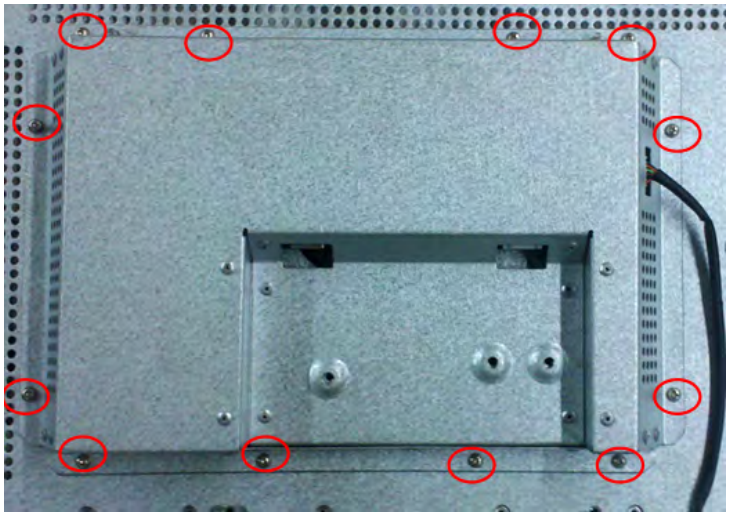


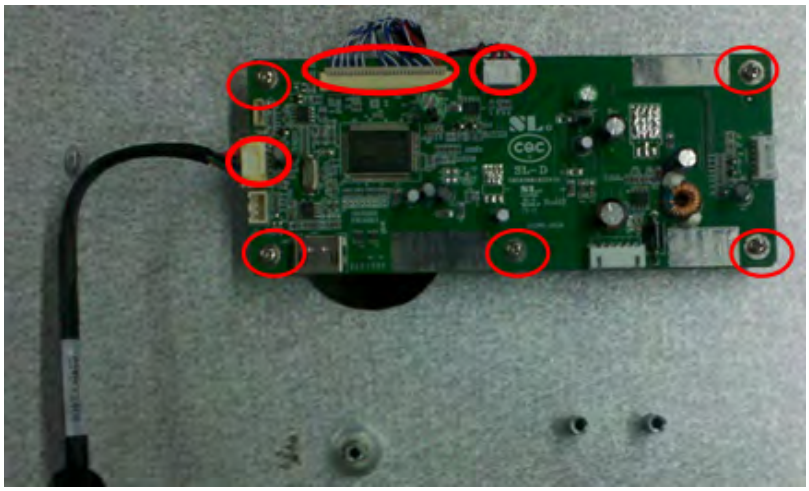
NOTE	If you can not insert the plug directly, please unscrew two PT3X10 screws and take out the keyboard to connect the plug, and then install it in previous place.

3. Install the monitor, refer to the reversed order in chapter 9.3.10.1;

9.3.10.3 Control Board

1. Remove the back cover of monitor. Refer to procedure 1 to 2 in 9.3.10.1.
2. Disconnect the cable shown in the figure and unscrew twelve M3X8 screws to open monitor shielding cover.

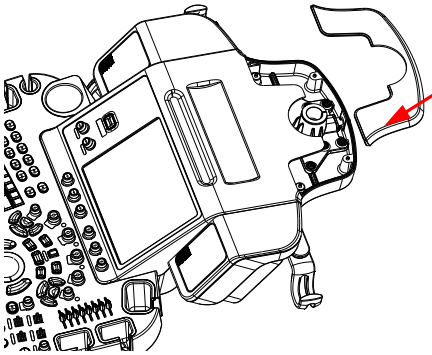




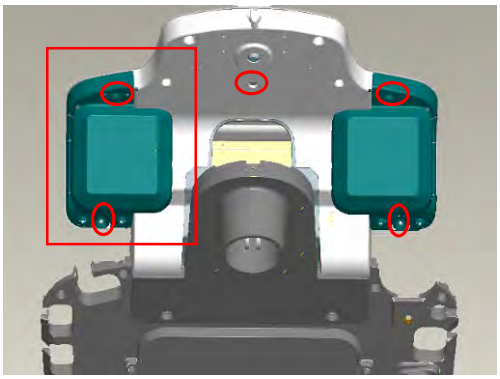
3. Pull out the plug of the control board, unscrew five M3X8 screws to remove the control board.

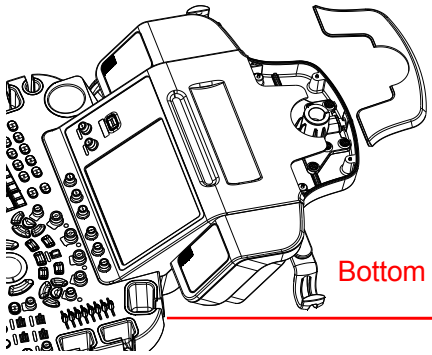
9.3.11 Minor Panel Assembly

1. From bottom to top, unscrew four M4X8 screws as shown in the figure below to remove the back cover of minor panel.



2. From bottom to top and two sides, unscrew seven minor panel M4X8 screws (two right and left, one in the middle and two at the bottom) as shown in the figure below.

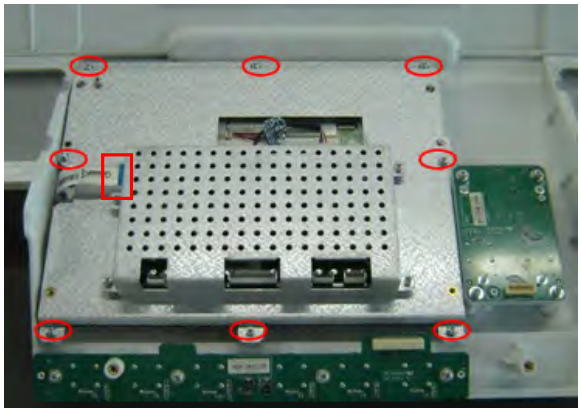




3. Move minor panel in the inclined upward direction and rotate to a certain position and then pull out the connection cable shown in the figure to remove minor panel assembly.

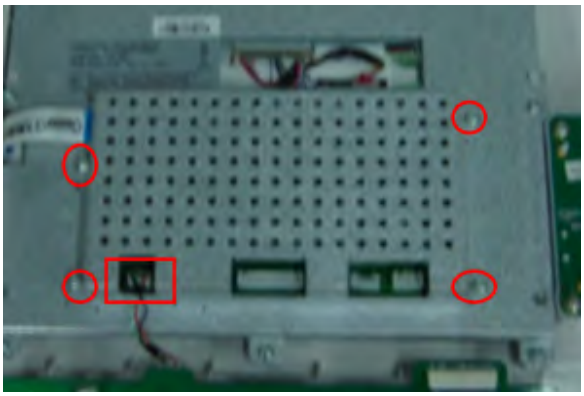
9.3.11.1 10.4 inch Display Assembly

1. On the minor panel, unscrew eight M3X8 screws and remove touch screen wire to remove 10.4 inch display assembly.

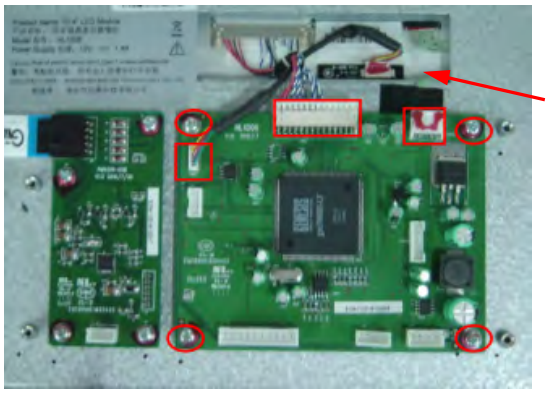


9.3.11.2 10.4 inch LCD Screen Control Board

1. Remove minor panel assembly. Refer to 9.3.11.
2. Pull out communication wire of touch screen and remove four M3X8 screws fixing the shielding cover to remove it.



3. Pull out the plug shown in the figure and unscrew four M3X8 screws to remove 10.4 inch LCD screen control board.

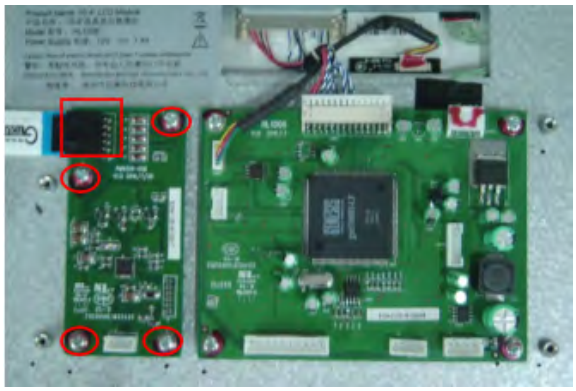


9.3.11.3 Touch Screen Module

◆ **Touch screen control board**

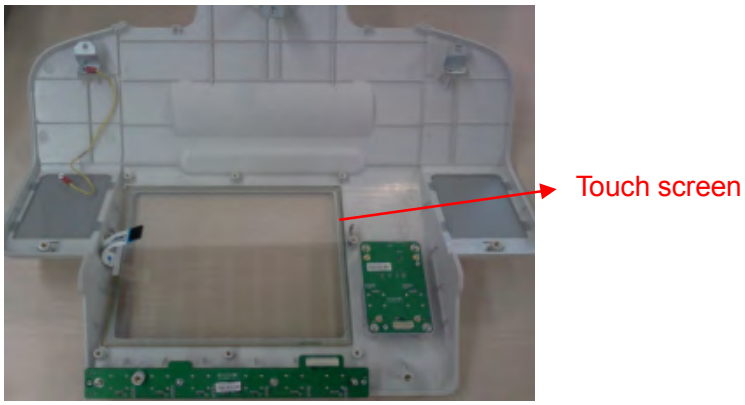
1. Refer to procedure 1 to 2 in 9.3.11.2.

2. Pull out the plug shown in the figure and unscrew four M3X8 screws to remove touch screen control board.

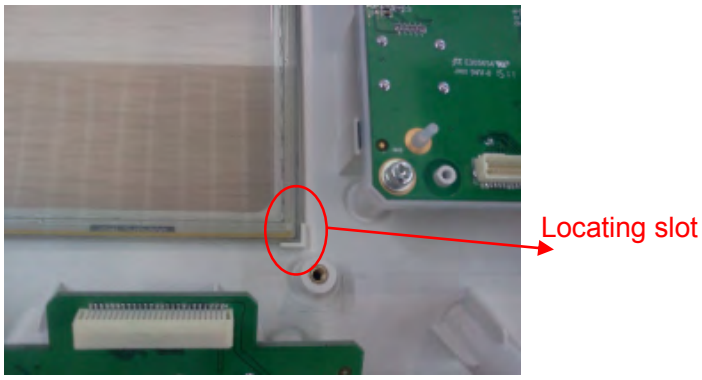


◆ **Touch screen**

1. Remove 10.4 inch display module. Refer to 9.3.11.
2. Lift the edge of touch screen slightly to remove touch screen.



3. When assembling, fix touch screen into the slots as shown in the figure.

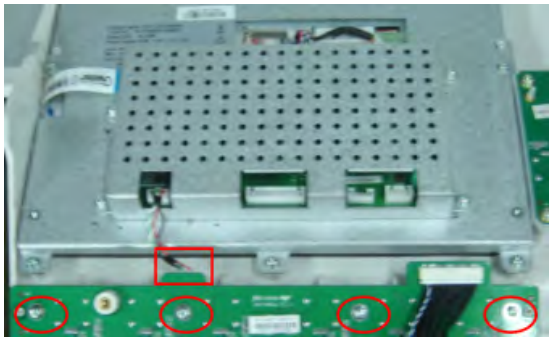


NOTE:	Please remove the protective film on the both sides before assembling touch screen and make it clean . Make sure the touch screen is put into the “L” locating slot to prevent damage

9.3.11.4 Minor Panel Six in One Encoder Module

1. Remove minor panel module. Refer to 9.3.11.
2. Pull out six covers of encoders.

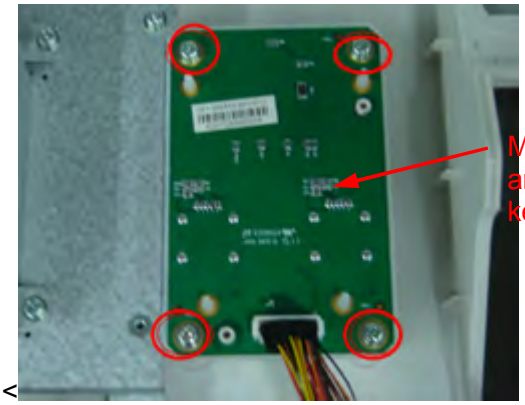
3. Pull out communication wire of touch screen and unscrew four M3X8 screws to remove six in one encoder module.



9.3.11.5 Minor Keyboard Module, Power Silicon Key

1. Remove minor panel assembly. Refer to 9.3.11.
2. Pull out two covers of encoders.

3. Turn over minor panel and unscrew four M3X8 screws to remove Keyboard and power silicon keypad assembly



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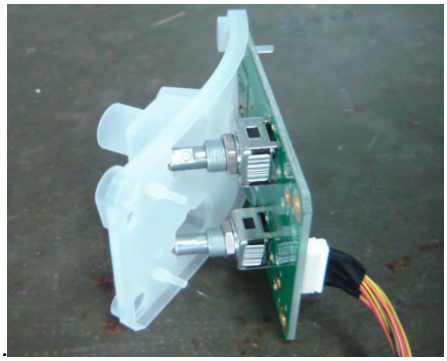
4. Pull out four pins of power silicon key and remove it. The left part is minor keyboard.



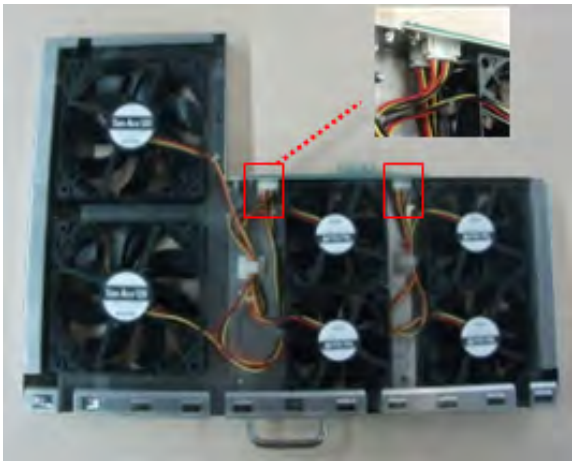
9.3.12 Others

9.3.12.1 Fan

◆ **Air outlet fan**

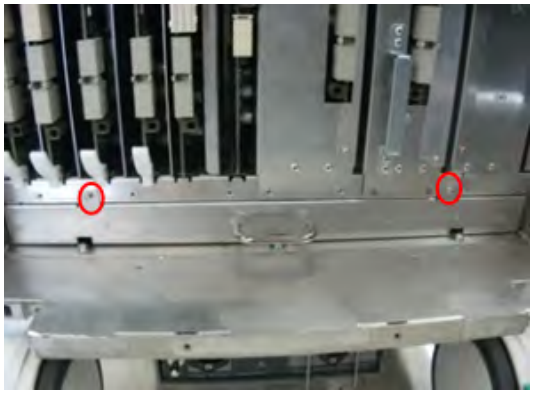
1. Remove the rear cover. Refer to procedure 1 and 2 in 9.3.3.
2. Unscrew two M3X8 screws to remove air outlet fan box.

3. Loosen wire tie and pull out three plugs shown in the figure.



4. Unscrew eight screws to remove one group (totally three groups each of them includes two fans).

1. Remove the rear cover. Refer to procedure 1 and 2 in 9.3.3.
2. Unscrew two M3X8 screws to remove air inlet fan box.

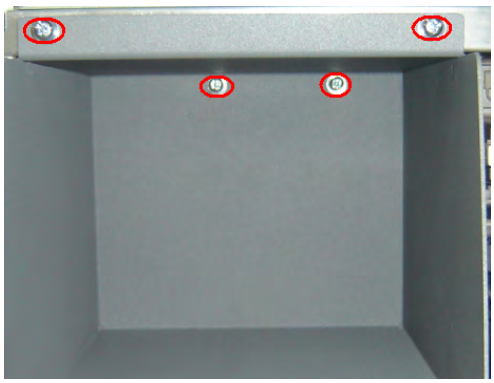


3. Refer to disassembly of outlet fan to disassemble one group fan

NOTE:	When assembling, direction of fan label should keep accordance with the one on the fan next to it ,And don't mix them up.

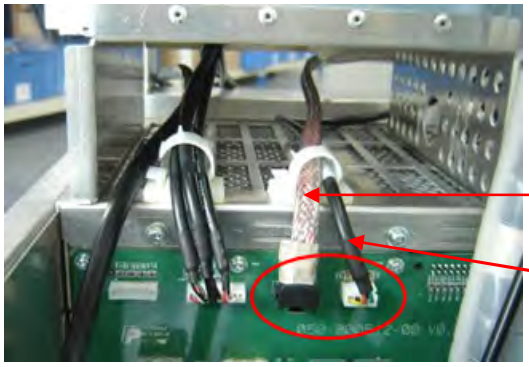
9.3.12.2 DVD-R/W

1. Remove main unit front cover (refer to procedure 1 to 5 in 9.3.2) and rear cover (refer to procedure 1 and 2 in 9.3.3).
2. Unscrew four M4X8 screws to remove the storage box.



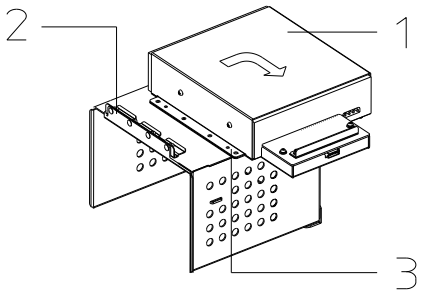
3. Loosen the cable buckle. Pull out the power cable connecting DVD-R/W with back-end

motherboard and pull out SATA signal cable. Put the cable behind machine rack.



4. Remove the 2 M4X8 screws which are used to fix the DVD-R/W module.

5. Take out DVD-R/W module to the left behind the machine, and separate the frontal edge fold from elastic sheet main unit rack to remove the module.

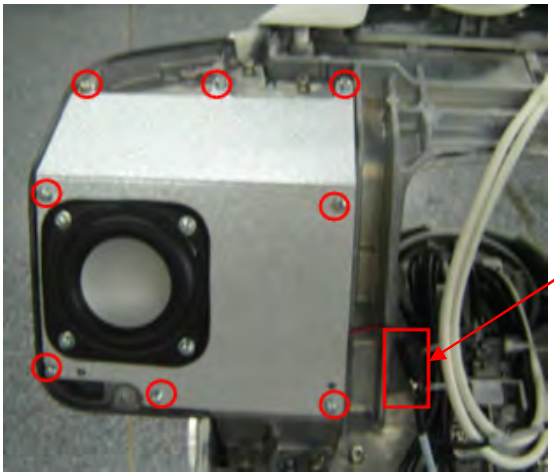


1, DVD-R/W module 2, Elastic Sheet of the Main Unit Rack 3, Edge fold of DVD-R/W

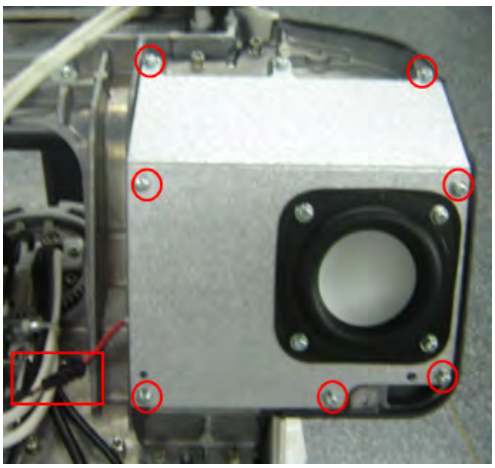
6. When assembling the module, put the edge fold of the module totally on the elastic sheet of main unit, and make the bottom guarding edge next to the main unit rack, meanwhile, try to press down the DVD-R/W button and locate the position if necessary.

9.3.12.3 Speaker assembly

1. Remove minor panel assembly. Refer to procedure 1 to 3 in 9.3.11.
2. Pull out connection cable shown in the below figure and unscrew eight M3X8 screws to remove left speaker assembly.



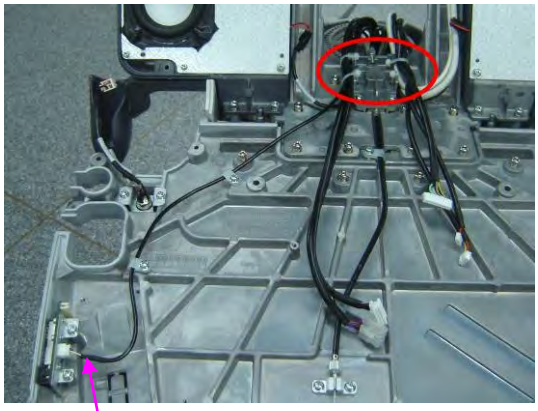
3. Refer to procedure 2 to remove right speaker assembly.

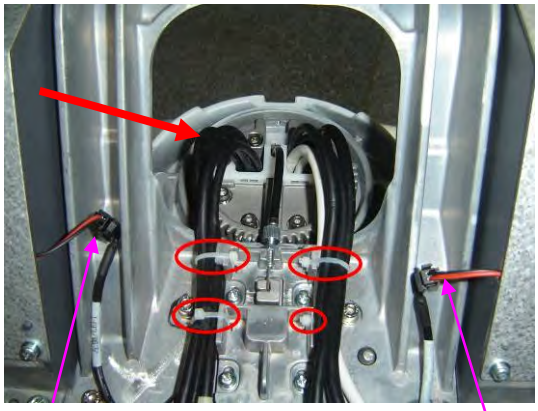


9.3.12.4 Disassembly of Gas spring Assembly

1. Remove the probe board assembly according to section “9.3.2”, Remove the Control Panel Assembly according to section “9.3.9”, and Remove the Minor Panel Assembly according to section “9.3.11”.
2. Unscrew one M4X12 Philips panhead screw and remove the rear cover.

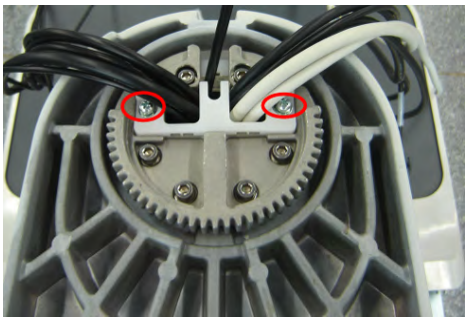
3. Pull out the MIC connection cable, cut off cable tie (4), pull out left/ right speaker plugs.



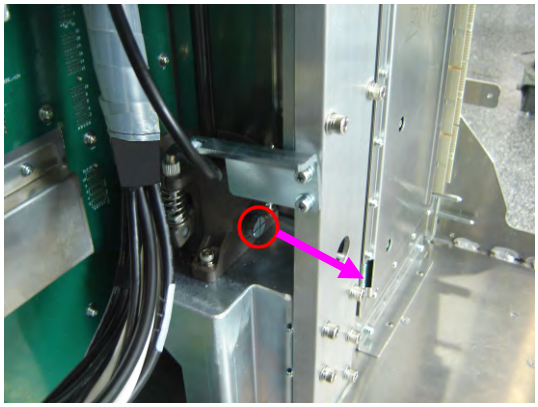


MIC connection cable left speaker cable right speaker cable

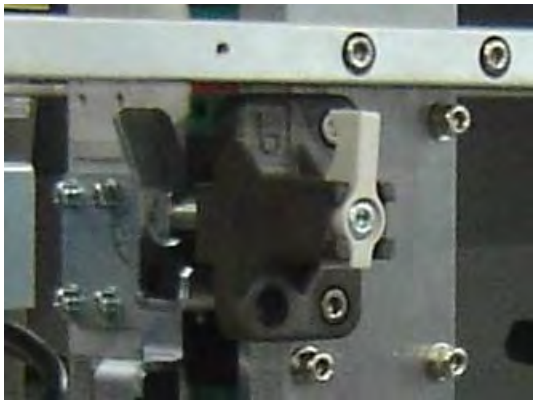
4. Remove Philips panhead screw M4X12 (2 pcs), and take out cable separation block.



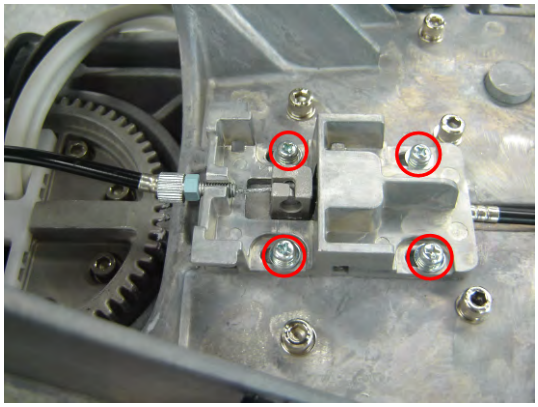
5. Remove the lower bolt of gas spring from gas spring guide holder.

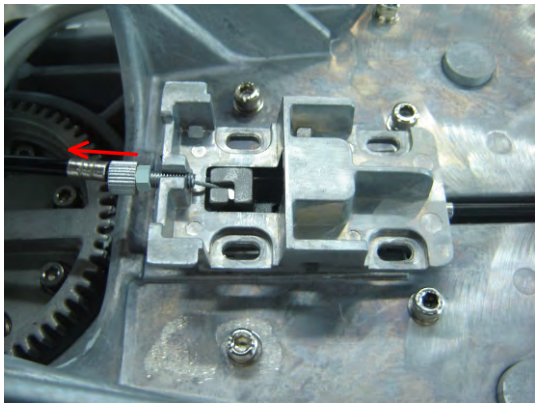


6. Drag out the locking handle and turn anticlockwise to the locking position of vertical up, and then turn the controlling handle and lift the upper main body until a click is heard; at this time, the upper main body is locked and it cannot go up or down.

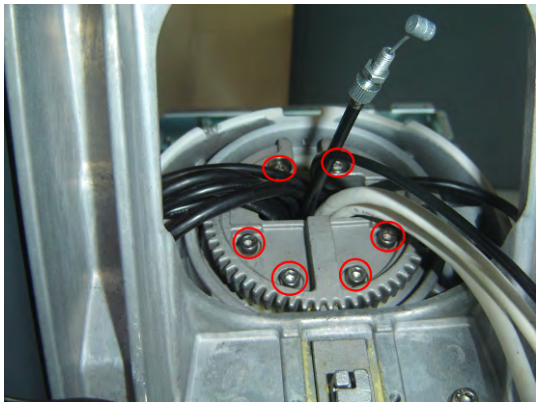


7. Remove Philips panhead screw M4X12 (4 pcs), loosen sliding block to take out the lifting line bolt and take out the lifting line from sliding block.

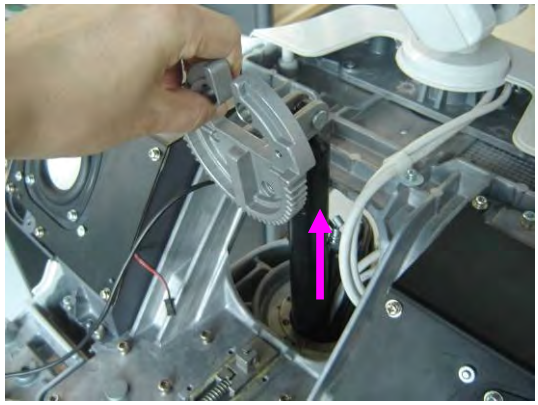




8. Then remove the round inner head screw M5X16 (6 pcs) with flat/elastic washer on the rotary gear.

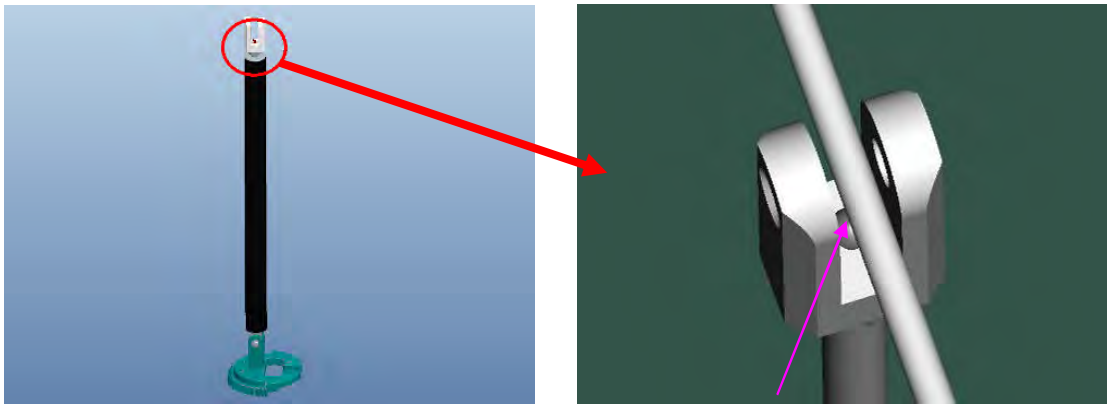


9. Lift the gas spring assembly while turning the rotary gear forward, take out all cables and lines from rotary gear shedding, and pull out the gas spring assembly from the main body.



◆ **Install Gas Spring Assembly**

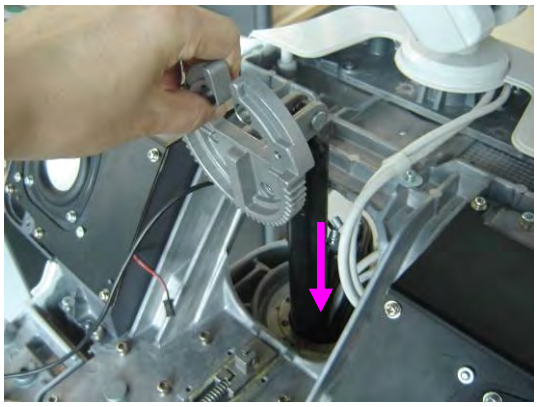
1. Make the new gas spring assembly stand with rotary gear facing floor, and use a manual Philips screw driver to push check valve to make the gas spring extend about 150-180mm.If the gas spring extends to maximum length, you should compress it 10-30mm backwards.

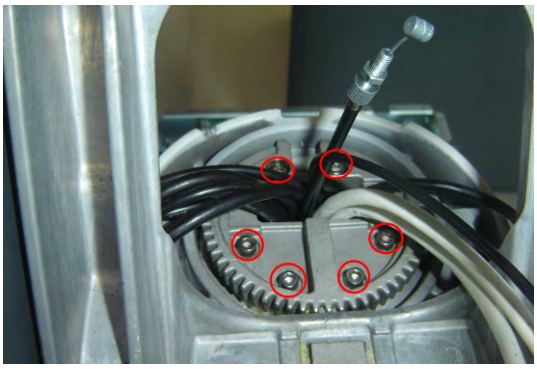


Check valve

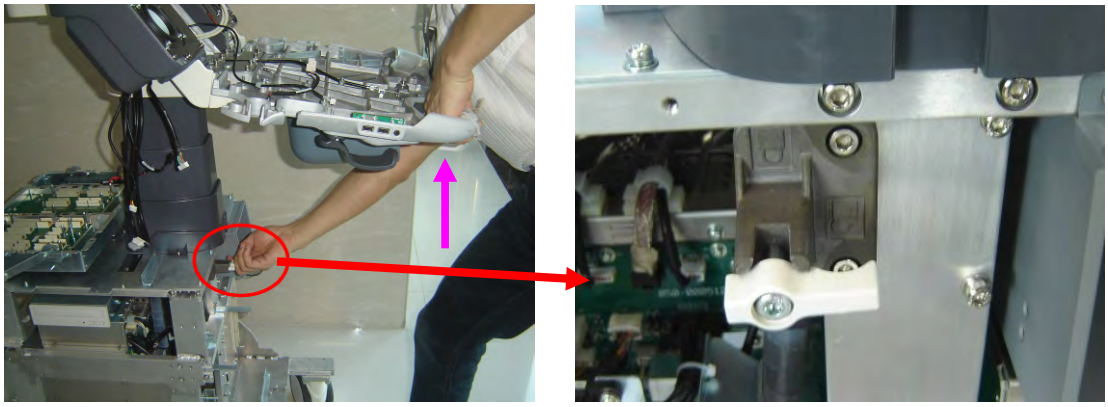
2. Check and make sure that the axial bolt hole of lower connecting link is parallel to rotating gear shedding direction.

3. Put the gas spring assembly into the main unit body vertically downward, guide all cables and lines into the rotating gear line hole, and then fix the rotating gear using removed round inner head screws and washer.

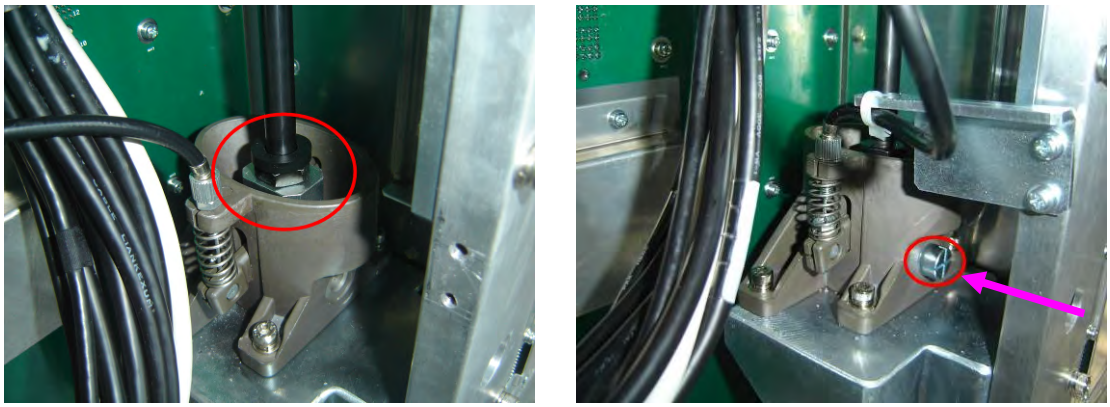




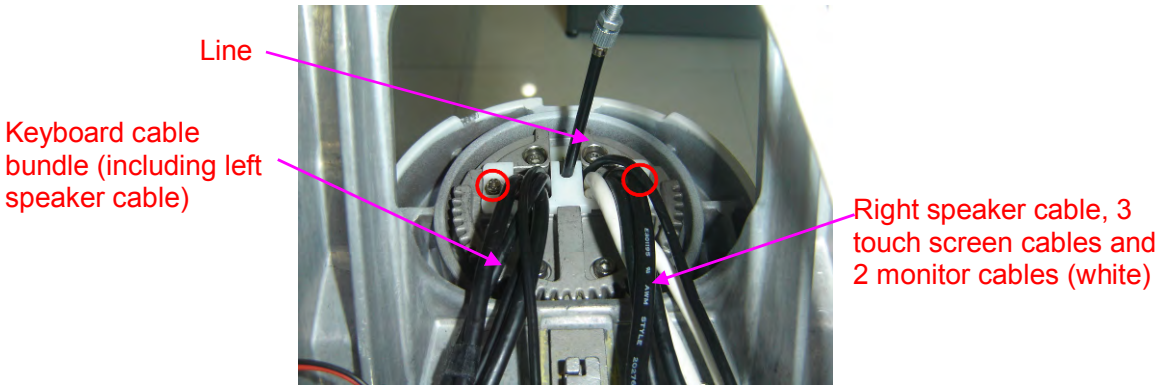
4. Lift the keyboard part, and pull out the locking handle until the unlock position and then put down keyboard part slowly until it reaches the bottom.



5. Check and confirm that the gas spring lower connecting link is put into the gas spring guide holder, and use the removed gas spring lower bolt to fix the gas spring lower connecting link and guide holder.

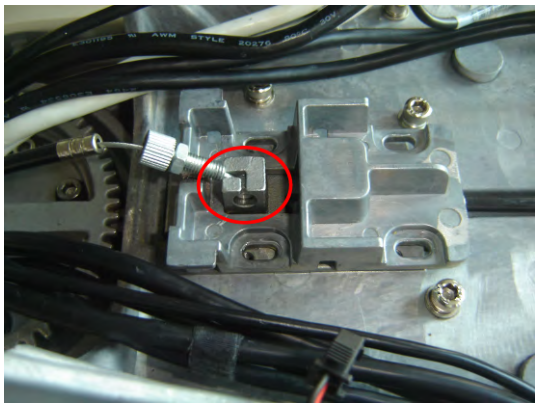


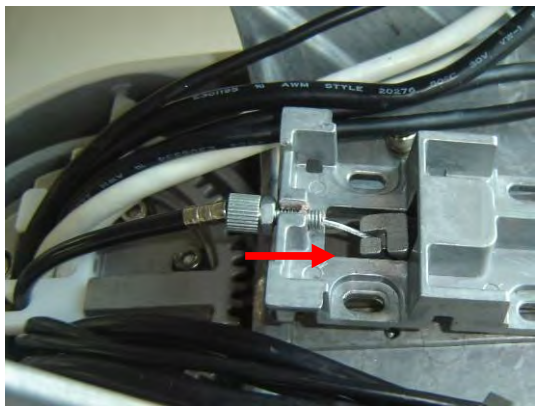
6. Tidy all cables and lines in corresponding hole of cable separation block as per the following picture, use Philips panhead M4X12 (2pcs) screw to fix the block.


Line
Keyboard cable bundle (including left speaker cable)
Right speaker cable, 3 touch screen cables and 2 monitor cables (white)

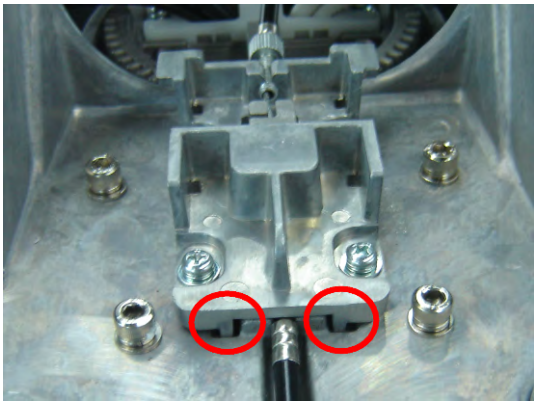
7. Rotate the hexagon screw of the lifting line to affix to the bolt end but not that tight.

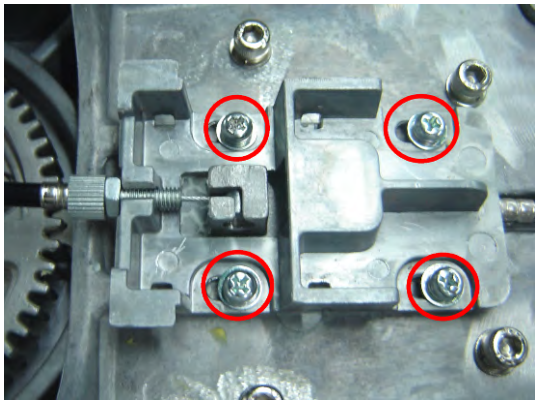
8. Use sliding block to cover limit sliding block, install the lifting line end into the locating groove of sliding block from the upper block side, and then screw the bolt all into open-ended screw hole of sliding block.



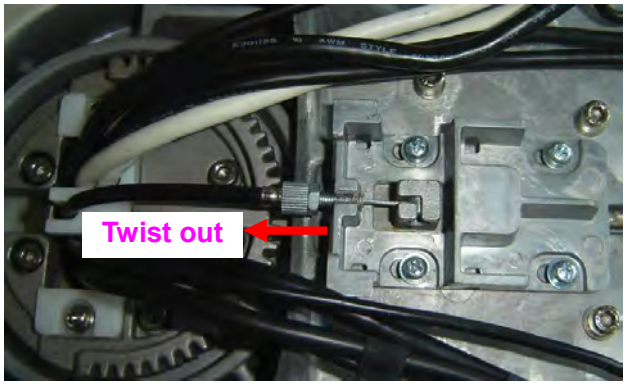


9. Install the bottom fixing edge of sliding block into locating groove on the base of the minor panel, use cross panhead screw M4X12 (4pcs) to fix.

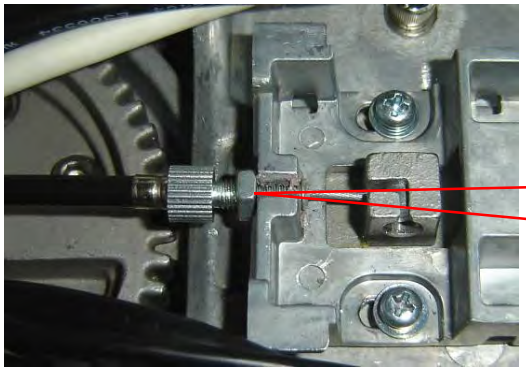




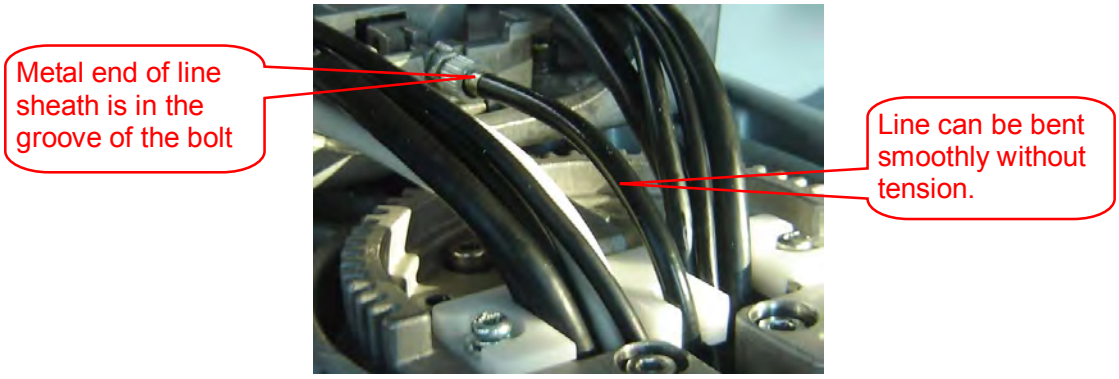
10. By unit of 0.5~1 circle thread, rotate the line bolt towards sliding block outwards until the main unit can be lifted from top to bottom using handle.



11. Use the hand to keep line bolt stay still, and use open-ended spanner8 to screw the hexagon screw towards sliding block tightly.

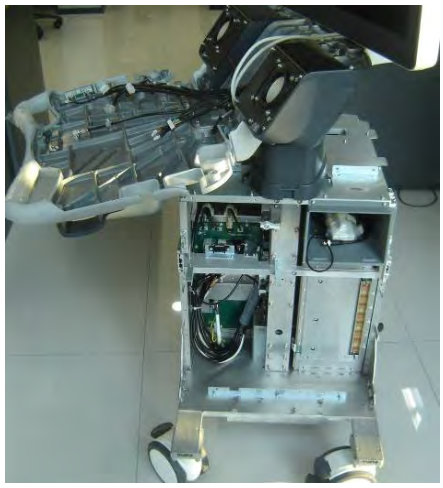


12. Check lifting line slack on the upper main unit, line can be bent smoothly without tension; metal end of line sheath is in the groove of the bolt.

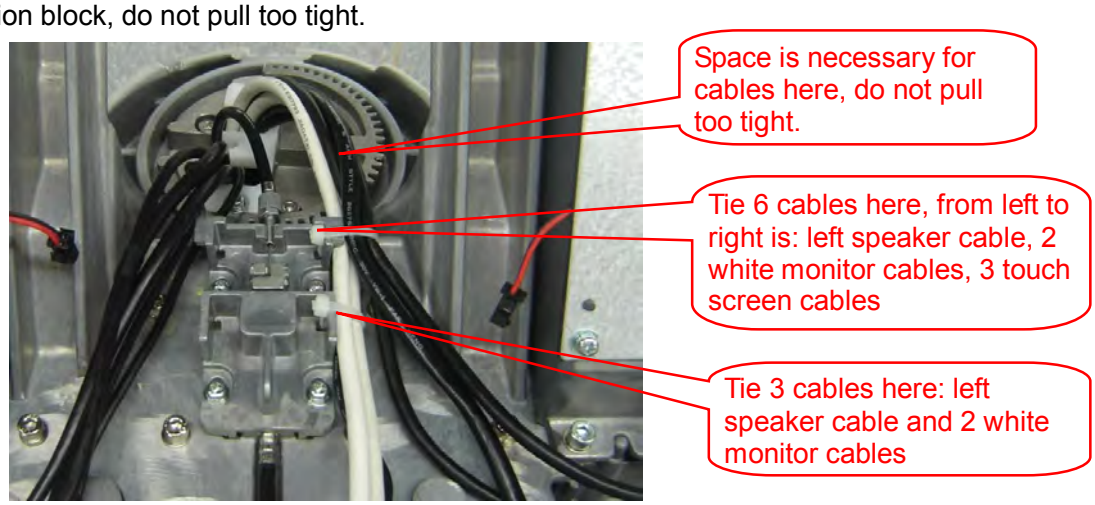


13. Turn the handle and perform keyboard part lifting for 3 times to check if every mechanism in the main unit is normal, and then make the keyboard part in bottom position and guide all cables into minor panel base.

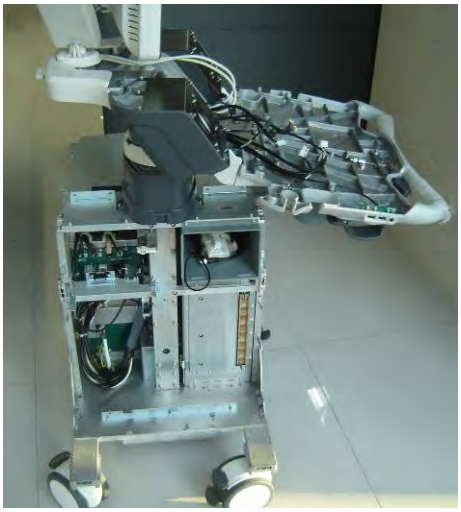
14. Turn the handle and turn the upper main unit 90° left.



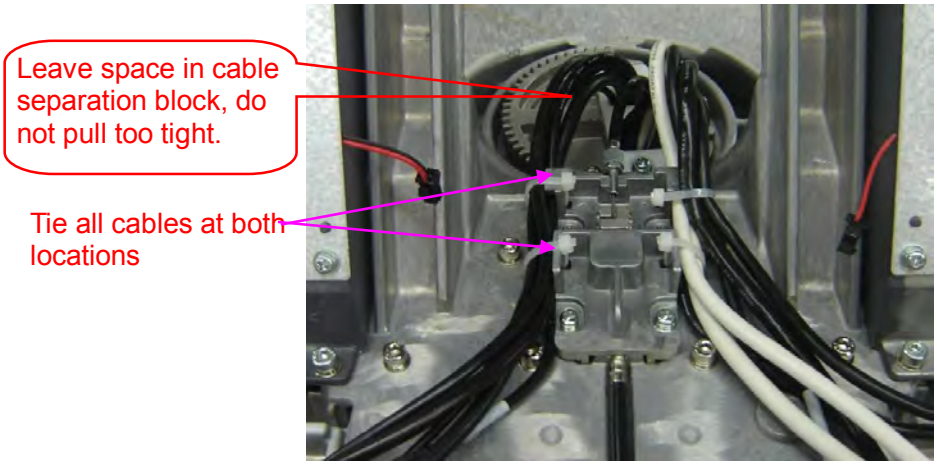
15. Tidy right speaker cable, 3 touch screen cables and 2 white monitor cables, use 2 cable ties to tie all cables in the 2 cable tie holes on the right of sliding block. Leave space in cable separation block, do not pull too tight.


Space is necessary for cables here, do not pull too tight.
Tie 6 cables here, from left to right is: left speaker cable, 2 white monitor cables, 3 touch screen cables
Tie 3 cables here: left speaker cable and 2 white monitor cables

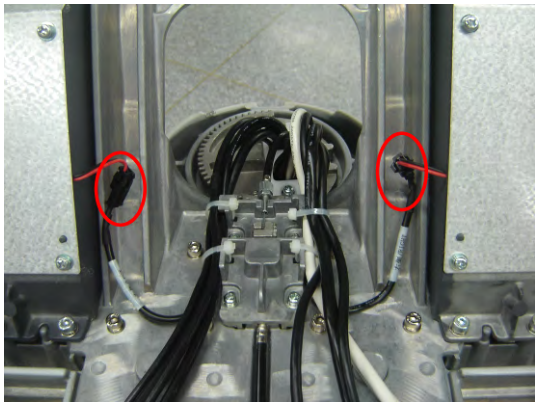
16. Turn the handle and turn the upper main unit 90° right.

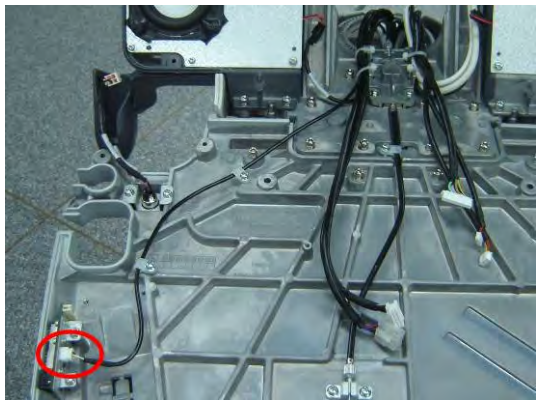


17. Tie cables of the other side, and use 2 cable ties to tie cables as required in the 2 cable tie holes on the left side of sliding block. Leave space in cable separation block, do not pull too tight.

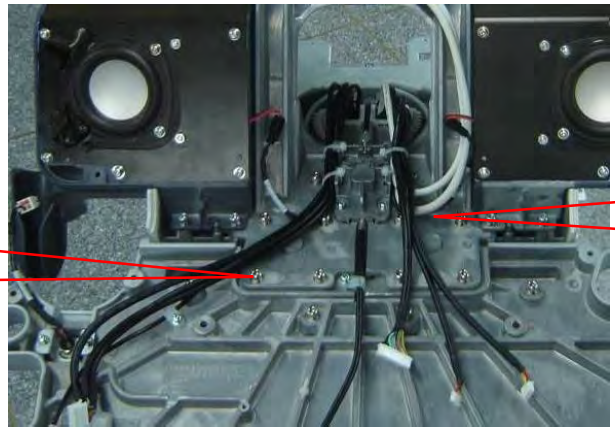


18. Connect left/right speaker cable with left/right speaker signal line; connect MIC connecting cable to USB adapter board as per the right picture in the following.

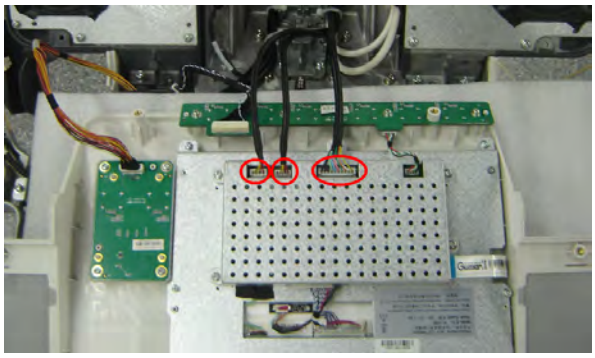




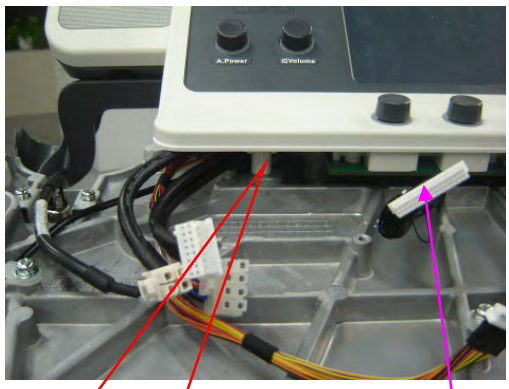
19. Do cable alignment as per required in the following picture for other cables.



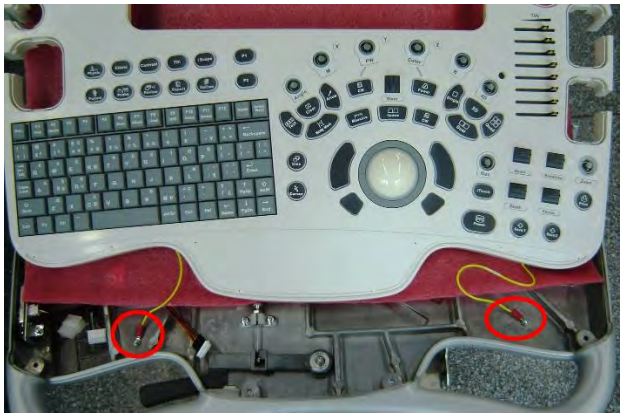
20. Connect 3 cables to corresponding sockets in the minor panel assembly.



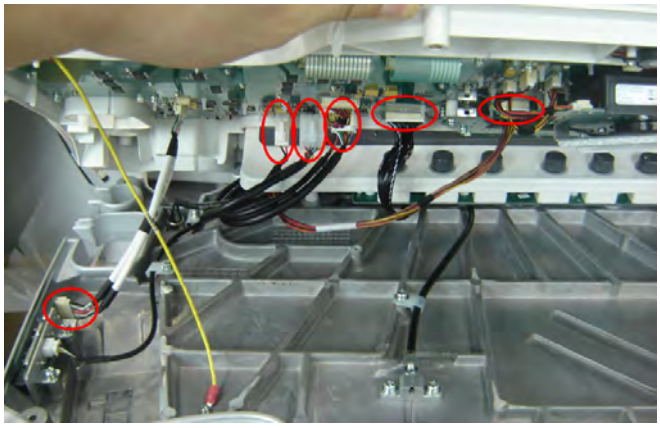
21. Rotate minor panel assembly, put the minor panel assembly on the cast-aluminum base, align cables as per the right picture in the following.



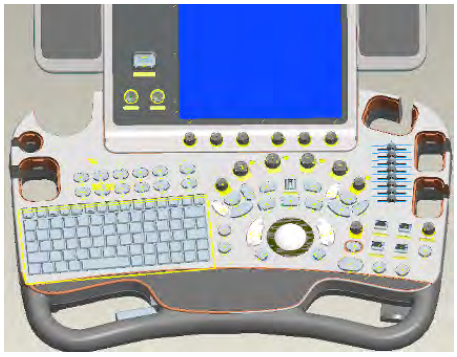
22. Use one piece of anti-static pearl cotton pad to protect minor panel, use M3X8 Philips panhead screws (2pcs) separately to fix 2 grounding cable terminals of control panel assembly to main panel base.

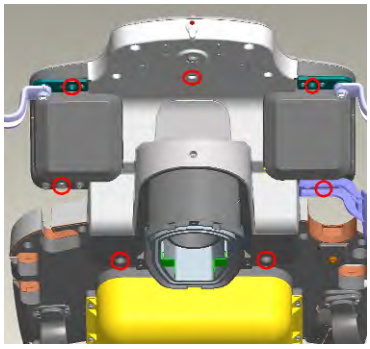


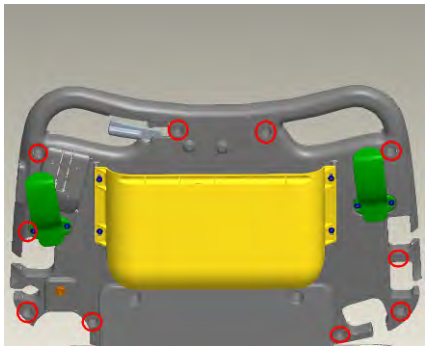
23. Align control panel assembly upper edge to lower edge of the minor panel assembly, and align them to the base position, lift control panel assembly bottom and connect 6 cables to corresponding sockets of keyboard board and base USB adapter board.



24. Align control panel assembly and main panel base position, check if installation joints on the control panel top cover and base are even and consistent, then use Philips panhead screw M4X12 (17pcs) to fix minor panel assembly first and then control panel assembly.



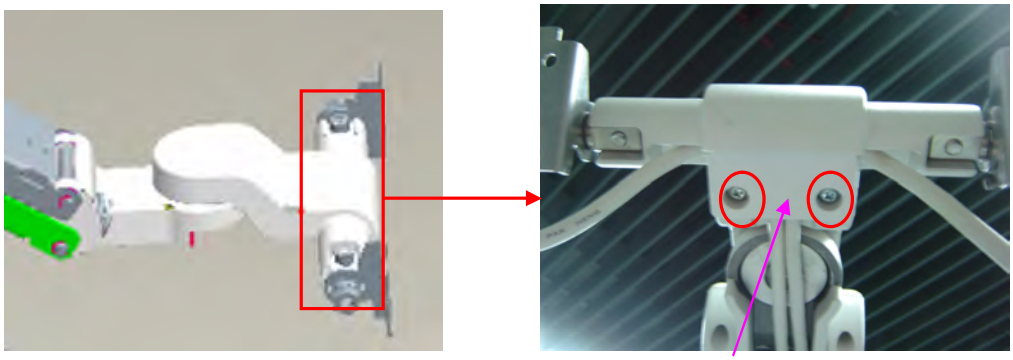




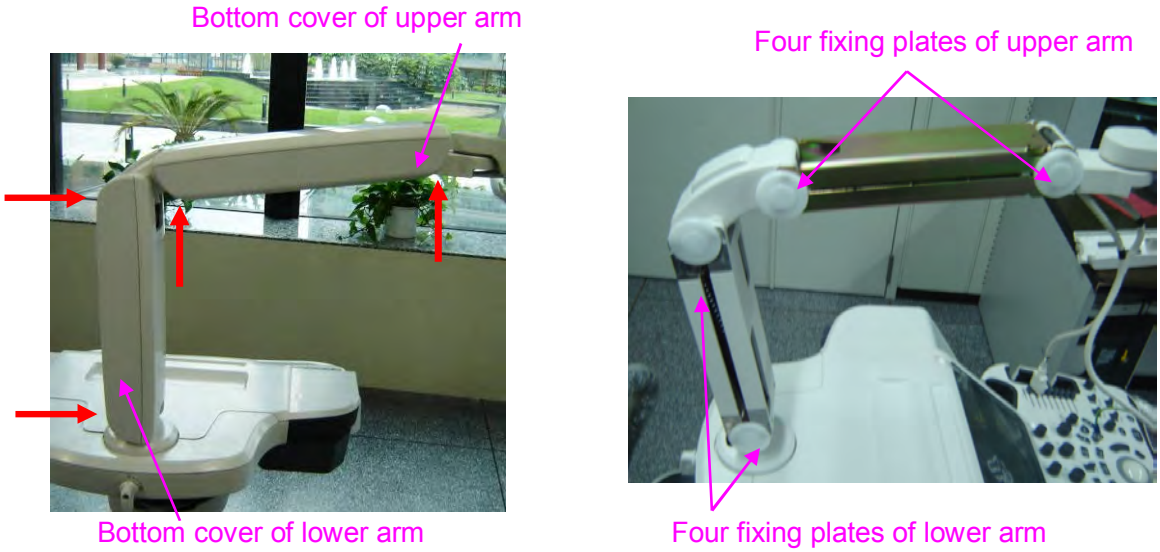
25. Install other removed components back to the main unit as per instructions in manual, and then the installation is finished.

9.3.12.5 Supporting Arm Assembly of Monitor

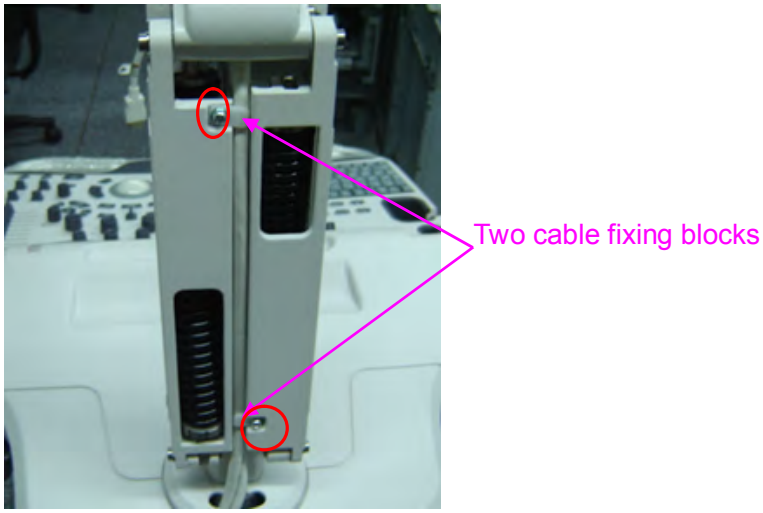
1. Remove the monitor assembly (referring to 9.3.10 the 1st~3rd step).
2. Remove 2 M4X12 cross panhead combination screws and take the cable fixing block as shown in the figure.



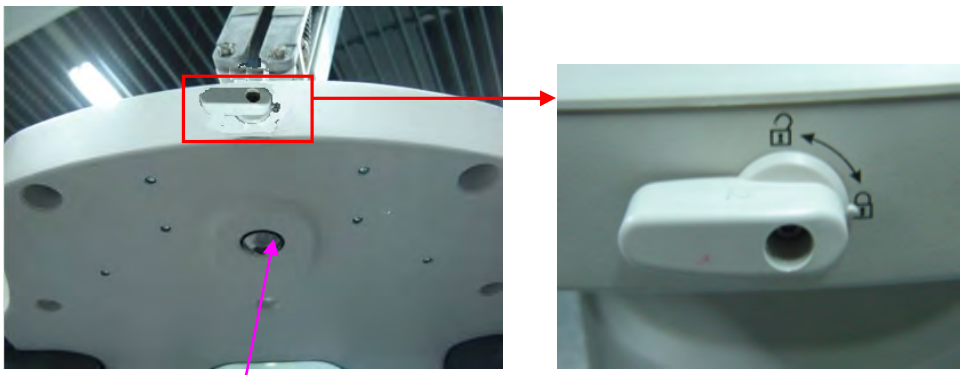
3. Remove 8 M3X8 cross panhead combination screws as shown in red arrow of figure. Take off the top cover and bottom cover of two arms; remove 4 fixing plates of each arm, too.



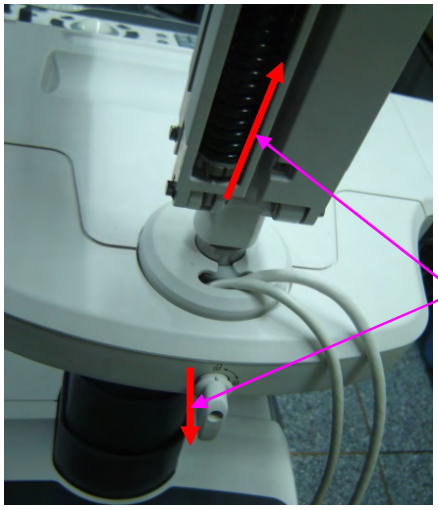
4. Remove 2 M3X8 cross panhead screws and take two cable fixing blocks as shown in the figure.



5. Pull out power line and signal cable (HDMI cable) of monitor. Note: pull out the power line first, then pull out the signal cable.
6. As shown in the figure, turn the lever of supporting arm clockwise to the locked state, then rotate the supporting arm left or right gently. The lever will move towards the base automatically to lock the supporting arm, which can't be rotated any more. Remove 1 M10X25 inner head screw and washer.

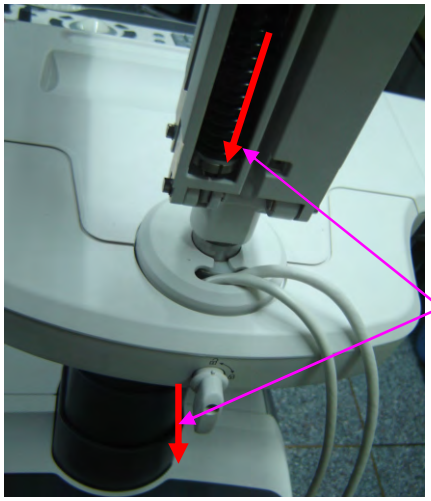


7. Turn the lever anticlockwise to unlock the supporting arm and pull it out to the end, at the same time, bring the supporting arm up, and you can remove it.

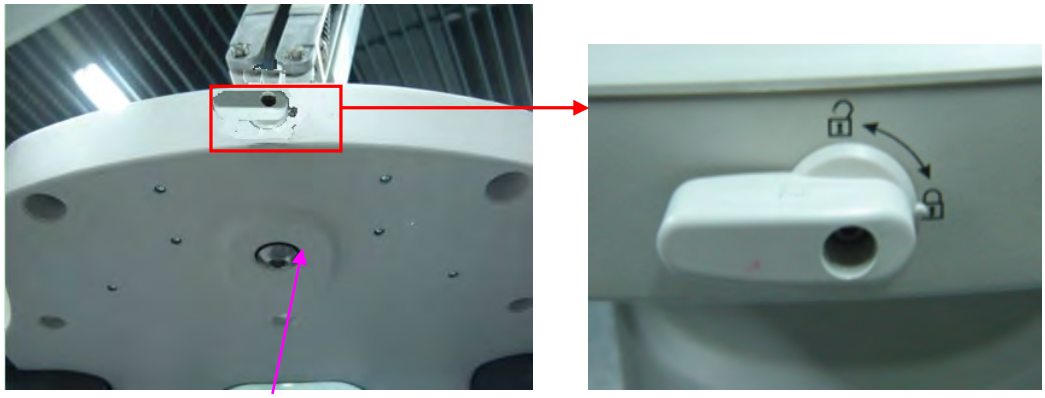


◆ **Install Monitor Assembly**

1. Pull the lever out to the end, then press the supporting arm down until the base axis is inserted into the base assembly of control panel completely and press the turning cover of supporting arm, at last, release the lever which will reset.

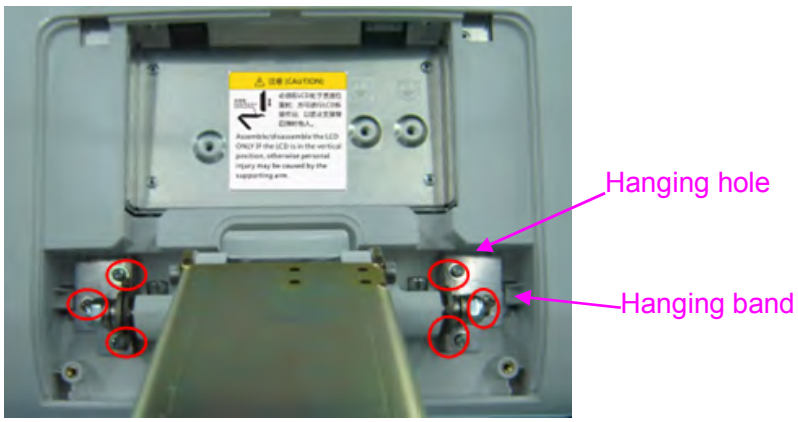


2. Turn the lever of supporting arm clockwise to the locked state, then rotate the supporting arm left or right gently. The lever will move towards the base automatically to lock the supporting arm, which can't be rotated any more. Use 1 M10X25 inner head screw and washer to fix the base of supporting arm from the bottom of minor panel.(Turn the supporting arm left or right, then turn the lever anticlockwise to the position downwards. The supporting arm assembly can be rotated smoothly, without any abnormity)。



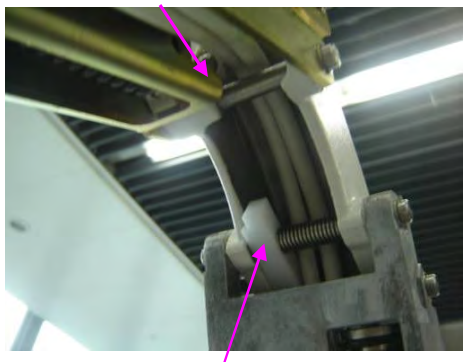
1 M10X25 inner head screw and washer

3. Put the rear cover of monitor near to the installation board of monitor, then move it downwards to insert the installation board into two hanging holes and two hanging bands, then use 6 M4X12 cross panhead screws to fix the monitor.



4. Visually check lifted/ lowered functions: make sure the monitor, upper arm/ lower arm can move normally when monitor is turned lifted/ lowered (-90，+20) degree, upper arm （-45，+10）degree, lower arm（-45，+25）degree. No abnormal sound exists and the monitor can keep still in each position.
5. Check rotation function: each part can be rotated left/ right normally, the rotating angle of monitor and lower arm are about -90~+90 degree. No abnormal sound exists and each part can be moved smoothly.
6. Adjust the lower arm in -45 degree and upper arm in +10 degree direction, then guide two cables of monitor into the connecting base from rotating axis of lower arm, and come out from rotating axis to the parallel cable groove of upper arm（Guide the signal cable first, then power line, tidy up two cables, too）.

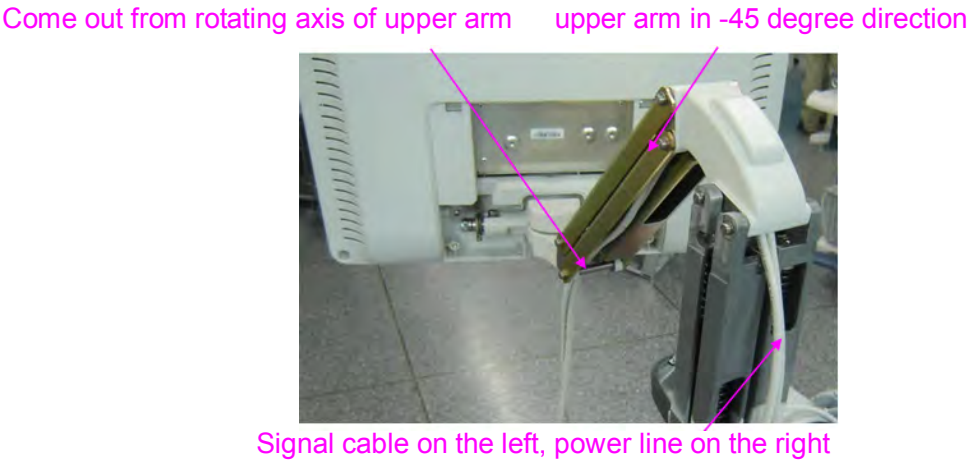
Come out from rotating axis of upper arm



Guide two cables into the connecting base from rotating axis of lower arm

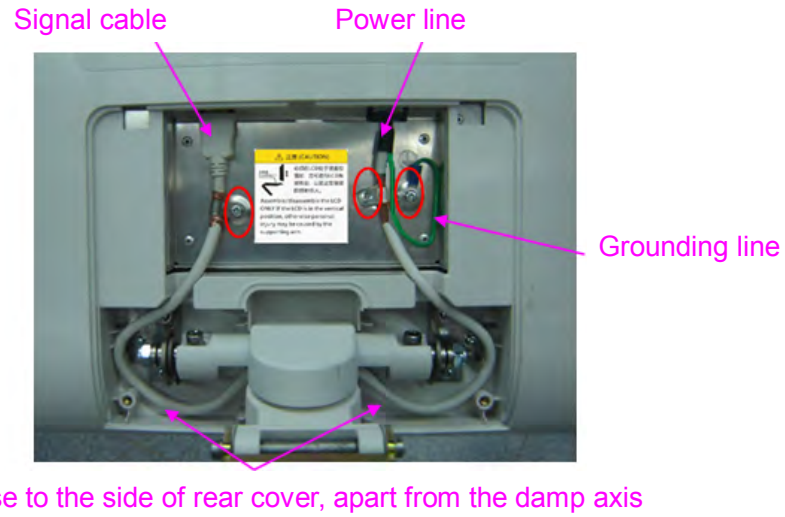
Note:	Guide the cables gently, side pull, sent one. So as to prevent the surface of cable from damage.

7. Adjust the upper arm in -45 degree direction, along the parallel cable groove, come out two cables from rotating axis of upper arm (first signal cable, then power line) and guide them into the top block. Then according to the installing position of cables, tidy them up. Cables must be in the supporting arm and can't twist together.

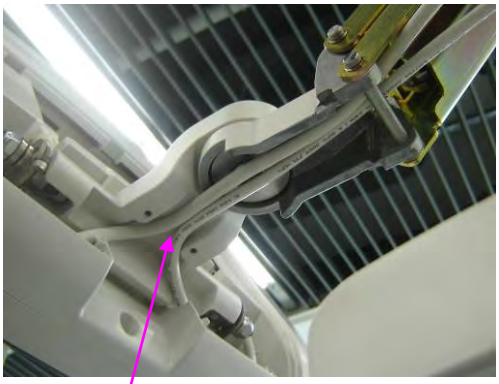


Note:	Guide the cables gently, side pull, sent one. So as to prevent the surface of cable from damage.

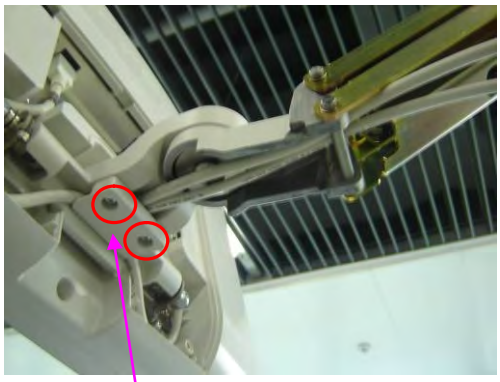
8. As shown in the figure, plug into signal cable and power line of monitor, fix two cable nips in the middle of shielding copper foil separately, then secure them with 1 M4X8 screw for each. At last, use 1 M4X8 screw to fix the grounding line.



9. Arrange two cables of monitor into the cable groove of connecting base from two sides to the middle, then use a cable fixing block and 2 M4X12 cross panhead combination screw to fix the cables in the groove.



Signal cable on the left, power line on the right

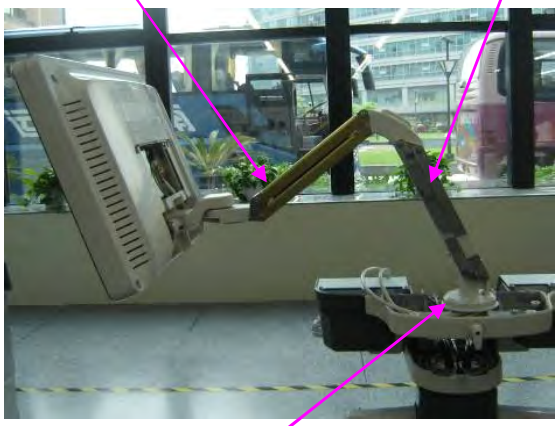


Cable fixing block

10. Adjust the lower arm and turn anticlockwise about 90 degree, adjust upper arm in -45 degree direction, lower arm in +25 degree direction, the supporting arm is the position in which interior cables are the longest at this time.

Upper arm in -45 degree

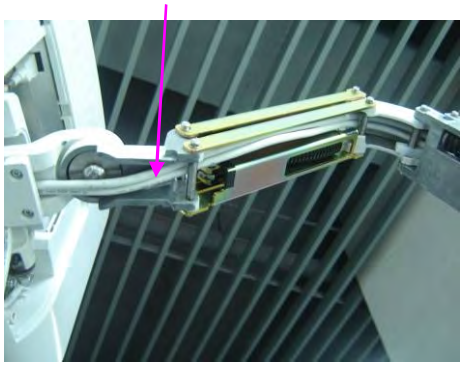
Lower arm in +25 degree



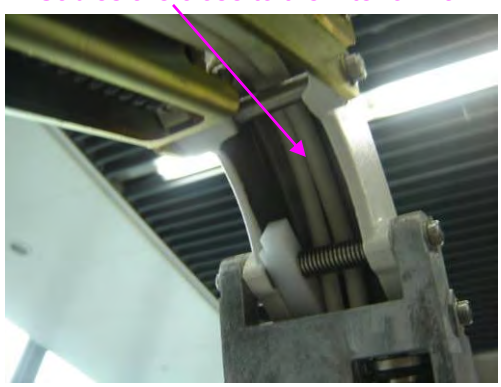
Turn anticlockwise about 90 degree

11. Two cables are in the cable groove of upper arm: cables in top block of upper arm are loosened and not too long seeing from lateral. Cables are close to the interior wall of connecting base.

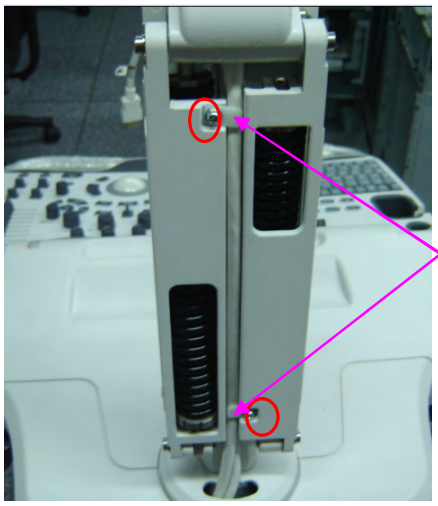
Cables are loosened and not too long



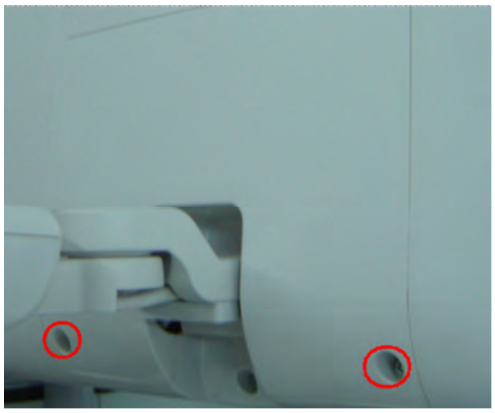
Cables are close to the interior wall



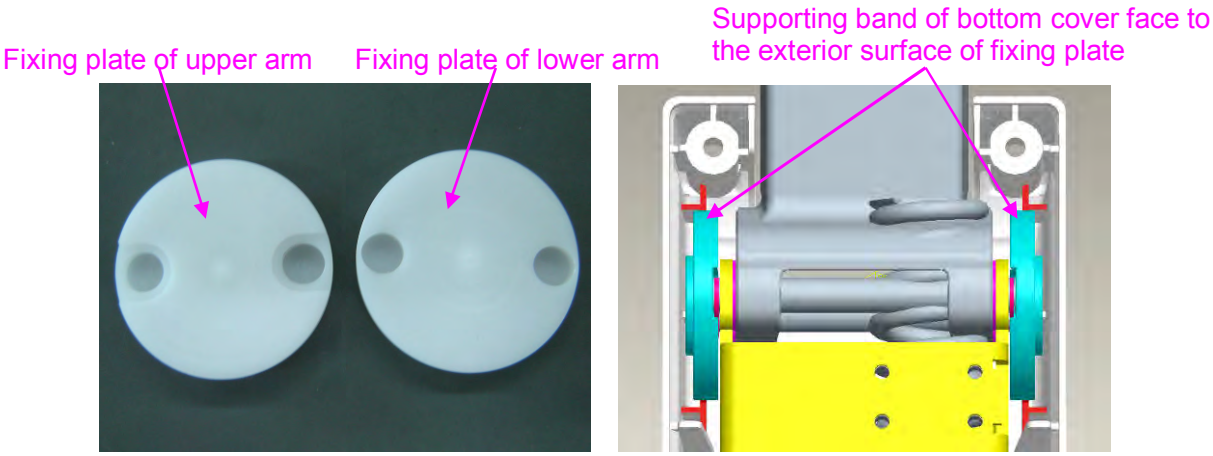
12. Arrange two cables of monitor into the parallel cable groove of lower arm, then use two cable fixing blocks and 2 M3X8 cross panhead combination screw to fix the cables in the groove.



13. Install the cable cover of monitor and fix it with 2 M4X12 cross panhead screws.



14. Install four fixing plates on two side's top of each rotating axis of upper arm, then close the top cover and bottom cover on base of fixing plate and use 4 M3X8 cross panhead screws to fix it, the installation of upper arm is finished. In the same way, finish installing the top cover and bottom cover of lower arm.

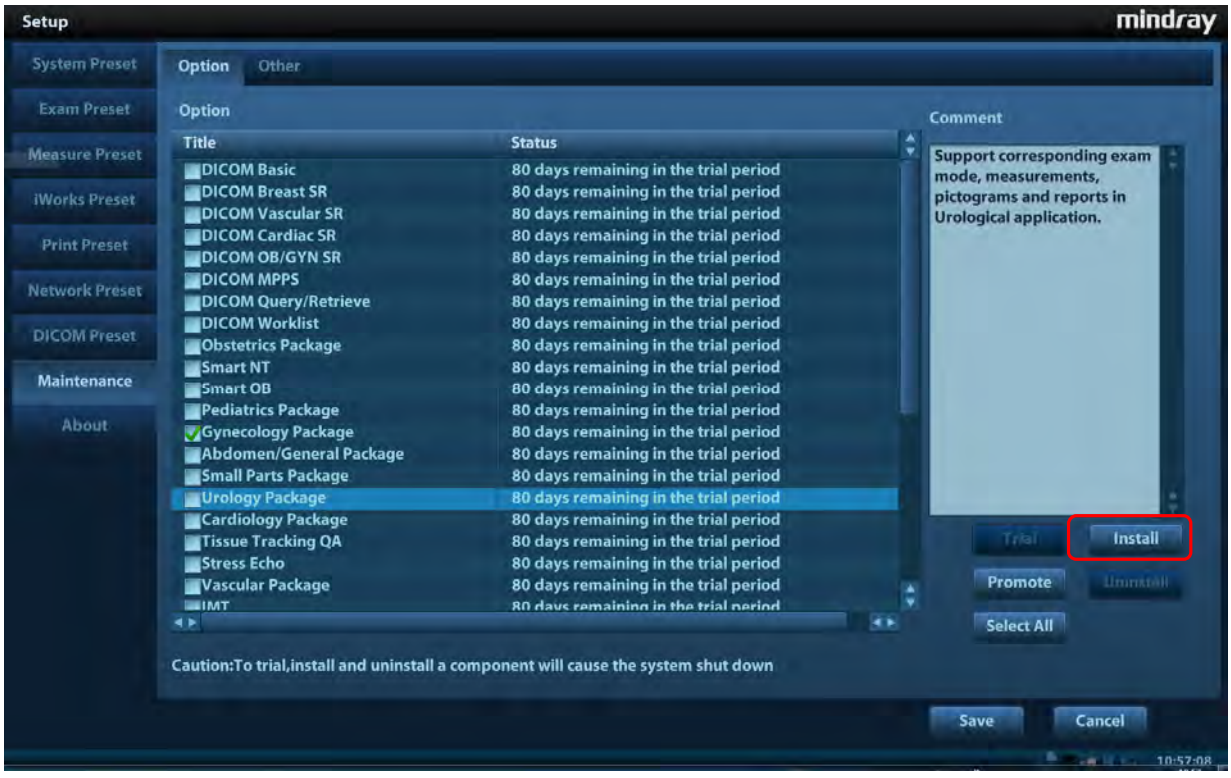

Fixing plate of upper arm
Fixing plate of lower arm
Supporting band of bottom cover face to the exterior surface of fixing plate

15. Checking: the upper arm/lower arm can be turned lifted/ lowered smoothly. No abnormity sound existed between covers and supporting arm. The installation is finished.

10 Optional Installation/Assembly

10.1 Installing Optional Software

1. Copy optional key file into U disk and connect it to USB port.
2. Open Preset menu and click [Maintenance] into [Option] in which select desired software function.

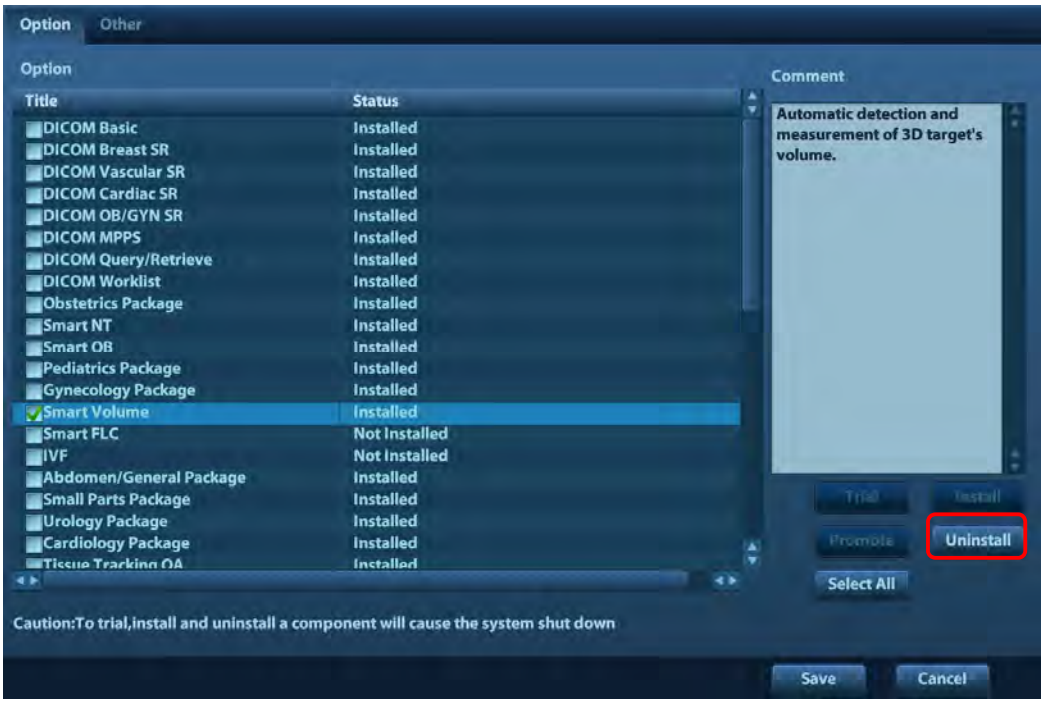


3. Click [Install] to pop up the dialog box and select requiring Key file and click [OK].
4. Return from preset after successful installation to find optional status is installed. After returning from preset, the requiring function can be used.
   - Trial: Select desired software, and then click the [Trial] and [OK] to use the software for 90 dyas.
   - Promote: select desired software, and then click [Promote] to see two selections: select [OK] to trial the selected software for 180 days; select [Cancel] to get a 365 days promotion for the software by the key provided by Mindray using MAC address.

NOTE:	1. Optional modules can be installed with Key singly. If the selected modules have been installed or two or more modules are selected, installation key is unavailable. 2. After all optional modules are installed, Please return to confirm.

◆ Uninstalling

1. Enter into [Option] menu, and in the list select the software package to be uninstalled.
2. Click [Uninstall] to pop up the [Confirm] dialogue box, and click [OK];



3. Return to the system preset interface, the optional devices status changes into "uninstalled".

NOTE:	Optional uninstalling is only available to internal users. Service engineers must log on as service.

10.2 Installing Optional Hardware

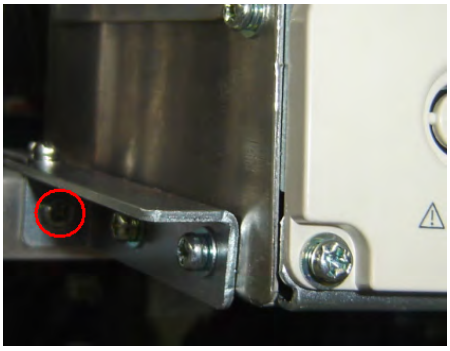
The optional hardware of the product are as follows:

NO.	Part Number	Part Name and Description	Material Photo	Assembly
1.	115-011005-00	Battery assembly material package		10.2.6
2.	115-010998-00	Front Board USB&ECG and Pencil Probe Port Assembly material Package(FDA)		10.2.1
3.	115-010999-00	For (CE)		
4.	115-011003-00	CW module material package		10.2.4
5.	115-011001-00	4D board material package		10.2.2
6.	115-011007-00	DVR material package	（with SD board）	10.2.5

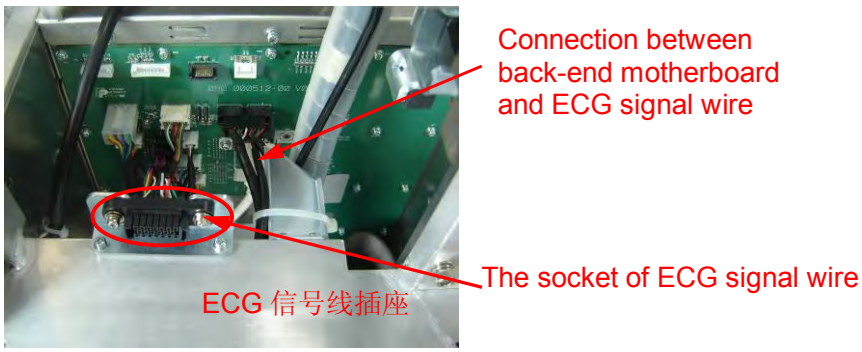
7.	115-027712-01	Gel warmer material package (with power adapter cable)		10.2.7

10.2.1 Front Board USB&ECG and Pencil Probe Port Assembly

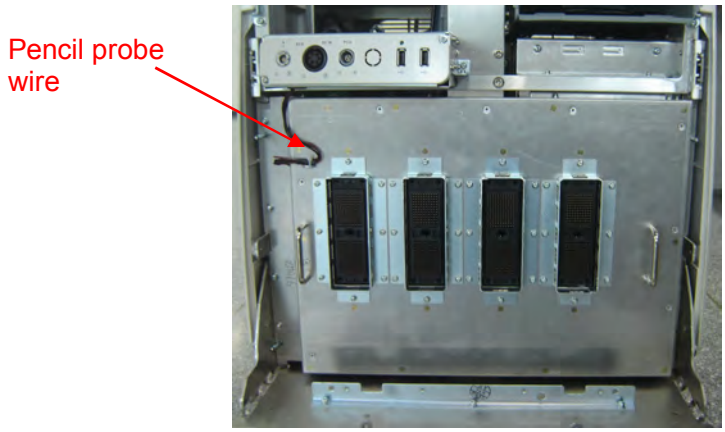
1. Remove the front cover. Refer to procedure 1 to 5 in 9.3.2.
2. Unscrew three M4x8 screws and hold front board USB assembly and then pull it out.



3. Confirm the connection between back-end motherboard and ECG signal wire is ok. The front board USB, ECG and pencil probe ports assembly is connected to the socket of ECG signal wire (former position of the front board USB assembly) and then fixed it to the main unit racket by three M3X8 screws.



4. If there is pencil probe wire on ECG module, plug the wire into the socket on the side of probe board assembly and fix it on the cable tie bridge of shield cover of probe board by one piece of cable tie.

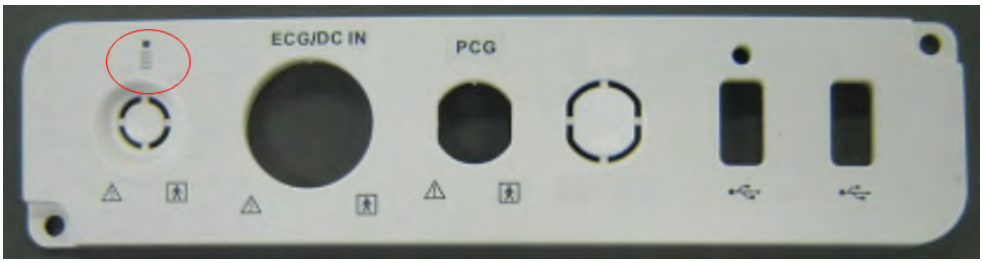


Front board USB, ECG and pencil probe ports assembly

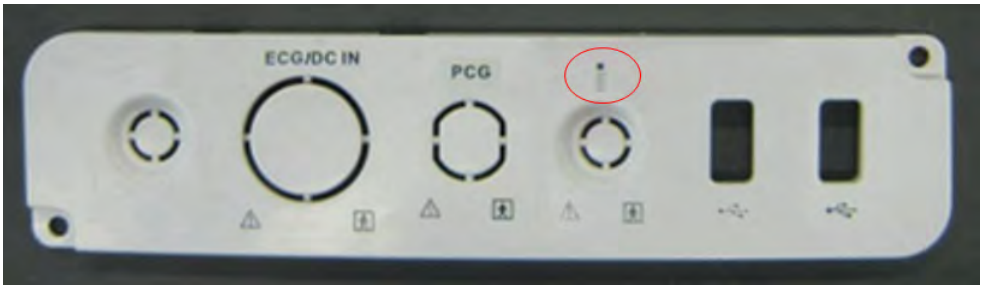
5. Refer to procedure 1 to remove front cover of the main unit and then reversely assemble the cover, printer cover and storage box cover. Assembly is finished.

NOTE:	If the front board USB&ECG and pencil probe port assembly is configured already, please check the panel appearance for further operation.

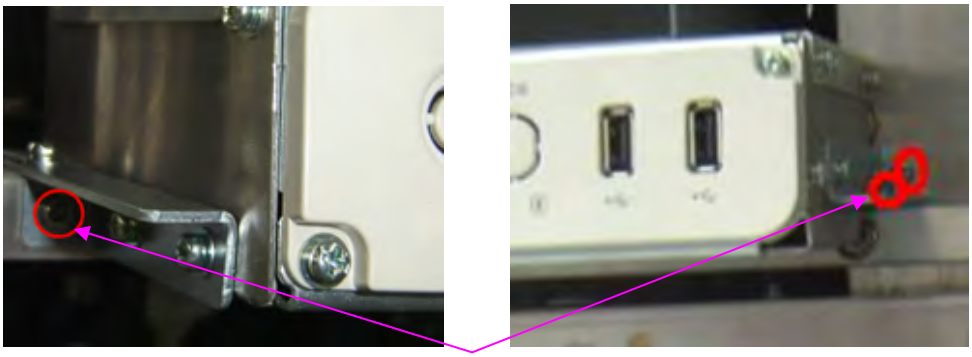
If the pencil probe silk print is on the leftmost position (as depicted below), please change the entire assembly by the procedures described in 10.2.1 chapter.



If the pencil probe silk print is on the position as depicted below, please install the pencil probe outlet and cable by the following procedure.



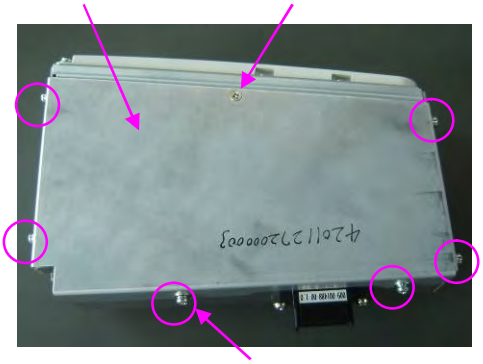
1. Remove the front cover of the main unit, refer to 9.3.2 chapter step 1-5 for details.
2. As shown in the following graph, remove the M4X8 Philips pan headed screws (3pcs) for fixing the front board USB&ECG and Pencil Probe Port assembly, grasp and pull out the assembly.



3 pcs of M4X8 Philips pan headed screws (1 pcs on the left, and 2 on the right)

3. As shown in the following graph, remove the M3X6 Philips sunk head screw (one pcs) and M3X8 Philips pan headed screws (6 pcs) for fixing the top cover to take out the top cover.

ECG top cover one M3X6 Philips sunk head screw



6pcs of M3X8 Philips pan headed screw

4. As shown in the following figure, cut cable tie for the ECG cable and PCG cable, tidy the cables and remove the M3X6 Philips sunk head screws (3 pcs) and M3X8 Philips pan headed screws (2 pcs) for fixing the front cover assembly. Pull the front cover assembly slightly for convenience. Distinguish the product model by figure a/b.

3 pcs of M3X6 Philips sunk head screws on the top

cable tie 3X100

left/right2 pcs of M3X8 Philips pan headed screws

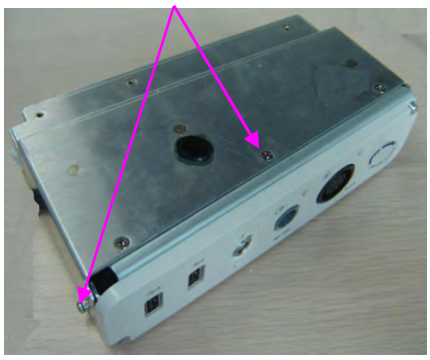


Fig a XP

Fig b （Win7）

5. As shown in the figure 4a and 4b, remove the M3X8 Philips pan headed screws(2 pcs) for fixing the ECG panel, take out the ECG panel and remove the sealing cover for the pencil probe port on the panel.(Front panel should be faced up so that sealing cover can be pressed down, and trim residual plastic edges without scratching the panel appearance. Note if the sealing cover position is right）.As shown in the 4c graph, assemble the panel back（Use 2 pcs of M3X8 Philips pan headed screws to fix the panel without fastening them, after gaps among the panels and outlets are adjusted evenly, fasten the screws）.Then remove the front nut of the outlet(provided with the pencil probe cable) from the pencil probe cable, screw the back hexagon nut towards the end of the screw thread; guide the pencil probe outlet through the corresponding pencil probe port hole on the ECG front cover (the locating slot should be upward), and then screw the front nut and make it parallel to the stud; fasten the back hexagon nut so as to fix the pencil probe cable on the front cover.

Figure 4A

Figure 4B

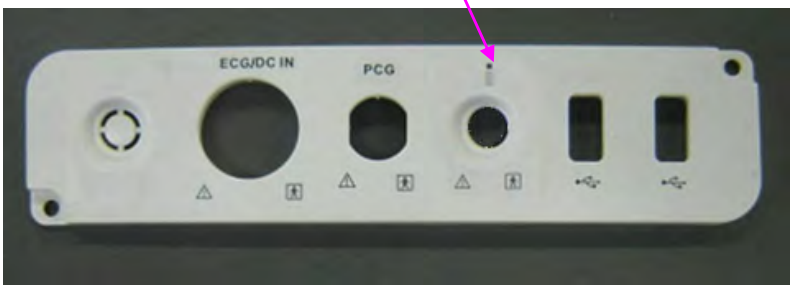
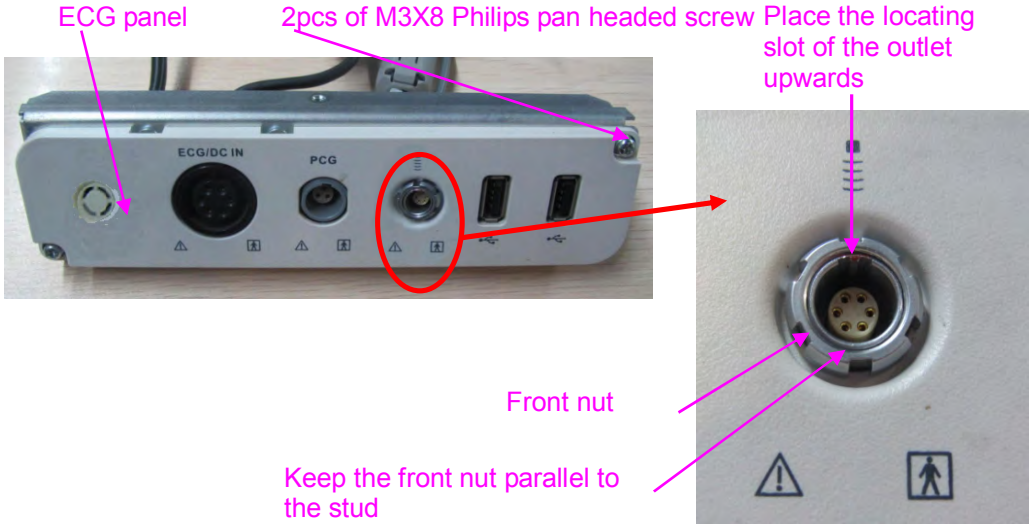


Figure 4C


ECG panel
2pcs of M3X8 Philips pan headed screw
Place the locating slot of the outlet upwards
ECG/DC IN
PCG
Front nut
Keep the front nut parallel to the stud

6. As shown in the figure 5A, thread the pencil probe cable through the line hole on the bottom base. Prevent from scratching the insulated coating when threading the cable ； as shown in the 5B and 5C, assemble the front cover assembly and bottom base assembly, use 3 pcs of M3X6 Philips sunk head screws and 2 pcs of M3X8 Philips pan headed screws to secure the assemblies. Prevent from damaging the boards or any components, take care when handling the panel appearance. Tidy the pencil probe cables, use one cable tie 3X100 to tie the pencil probe cable onto the cable-tie bridge on the ECG base, do not tie too tightly;

Pencil probe cable

Figure 5A(For XP)

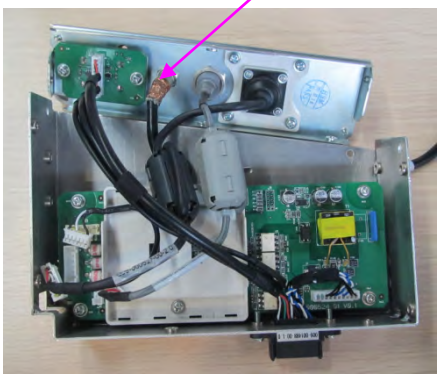


Figure 5B

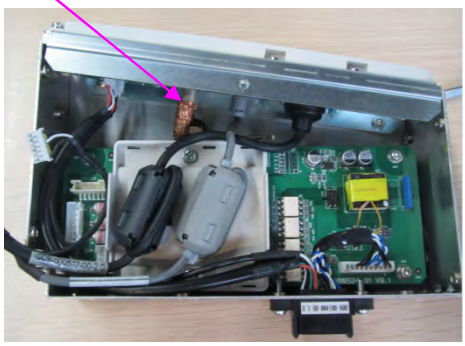
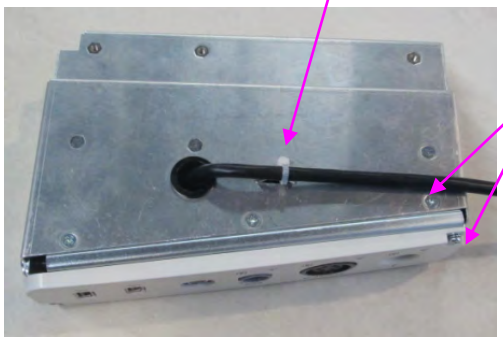


Figure 5C （Win7）

Figure 5D use cable tie 3X100 to tie the pencil probe cable onto the cable-tie bridge



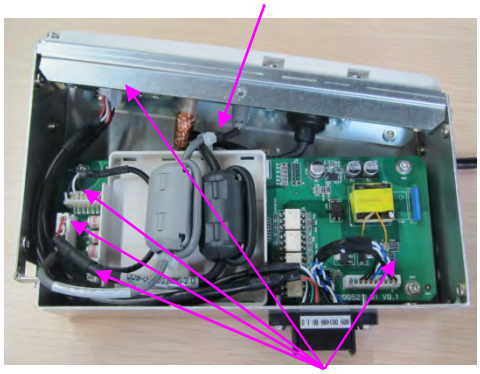
3 pcs ofM3X6 Philips sunk head screws on the top cover，2 pcs of M3X8 Philips pan headed screws on the left/right

7. As shown in the figure 6A, place the magnetic ring of the ECG cable and PCG cable onto the magnetic ring securing board, use one cable tie 3X100 to bind the 2 cables and tie to the 2nd cable tie hole on the depicted fixing board, place the exterior connector end of the ECG cable beneath the board. Tidy the cables, no cable pinch(stranding) is allowed, and do not tie too tightly. As shown in the figure 6B, tidy the cables by the assembly side wall: the longer cable of ECG internal cables should be on the bottom, and then place the ECG and PCG cable, confirm all outlets and connectors are securely connected.

Figure 6A

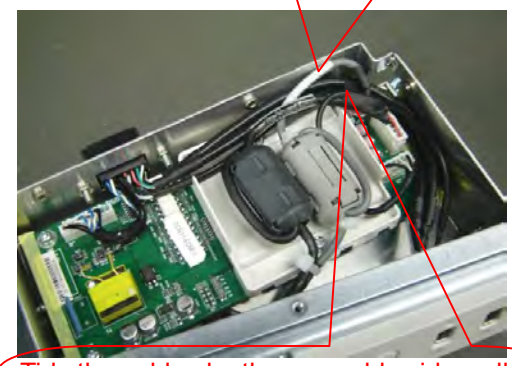
Figure 6B

Use the cable tie 3X100 to tie the 2 cables into the cable tie hole on the securing board; place the ECG cables beneath the board; lay the magnetic ring horizontally



Make sure all outlets and connectors are securely connected.

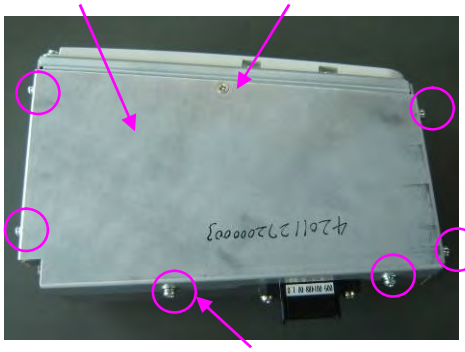
Cables should not block the screw hold on the side wall



Tidy the cables by the assembly side wall: the longer cable of ECG internal cables should be on the bottom, and then place the ECG and PCG cable.

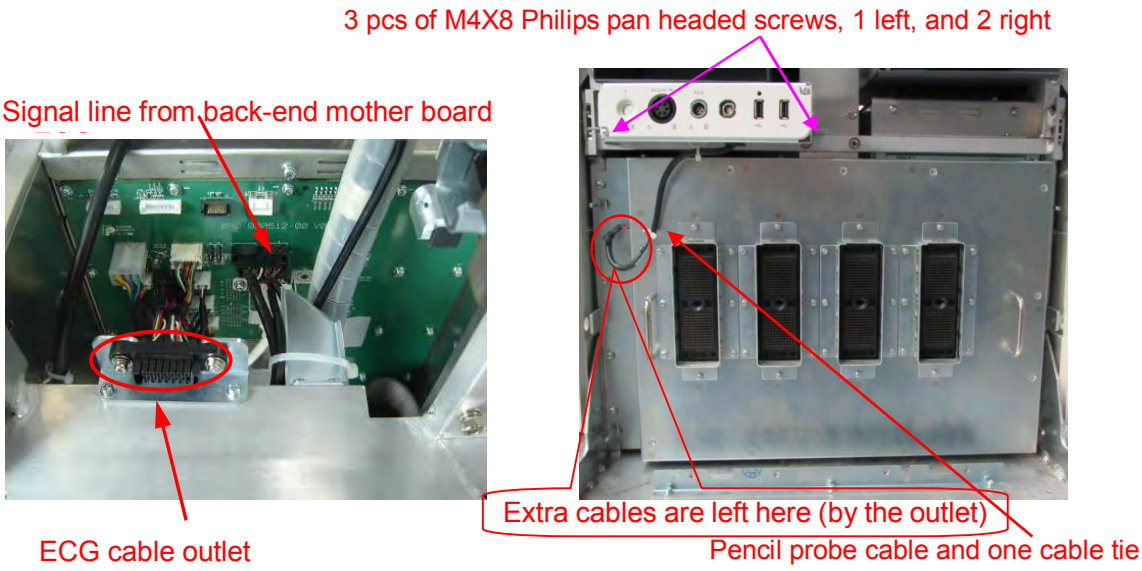
8. As shown in the following figure, use one M3X6 Philips sunk head screw and 6 pcs of M3X8 Philips pan headed screws to fix the ECG top cover and the assembly.

ECG top cover one M3X6 Philips sunk head screw



6pcs of M3X8 Philips pan headed screw

9. Confirm the connection from the back-end mother board to the ECG cable, and connect the front board USB&ECG and pencil probe port assembly to the ECG cable connector (previous front board USB assembly mounting location).And then use M4X8 Philips Pan headed screws (3pcs) to mount it to the main unit rack, insert the pencil probe line to the outlet on the upper left of the probe board, tidy the cables and use one cable tie 3X100 to fix the cables onto the probe board cable-tie bridge (extra cables be left by the outlet)


3 pcs of M4X8 Philips pan headed screws, 1 left, and 2 right
Signal line from back-end mother board
Extra cables are left here (by the outlet)
ECG cable outlet
Pencil probe cable and one cable tie

10. Refer to procedure 1 to remove front cover of the main unit and then reversely assemble the cover, printer cover and storage box cover. Assembly is finished.

10.2.2 4D Module

10.2.2.1 4D or 4D&TEE board and Signal Processing Board (supporting 4D/elastography)

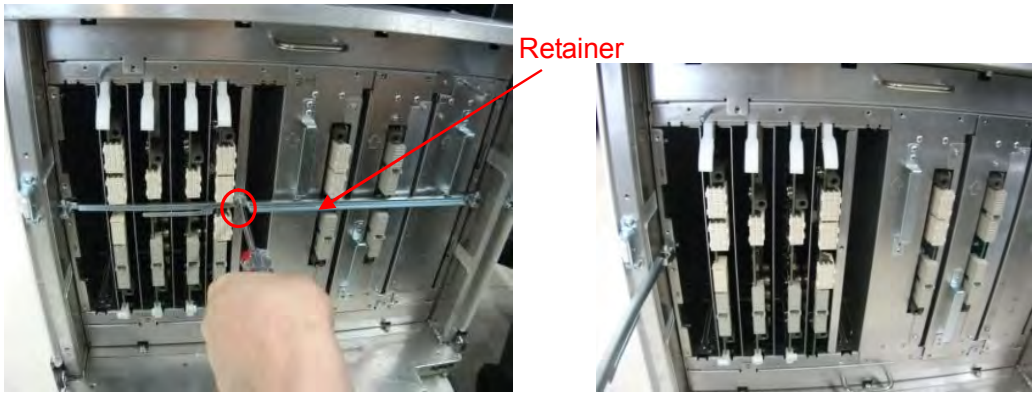
1. Remove the rear cover. Refer to procedure 1 and 2 in 9.3.3.
2. Unscrew two M3X8 screws securing the handle.

3. Unscrew 26 M3X8 screws fixing Communication Mother Board Assembly.

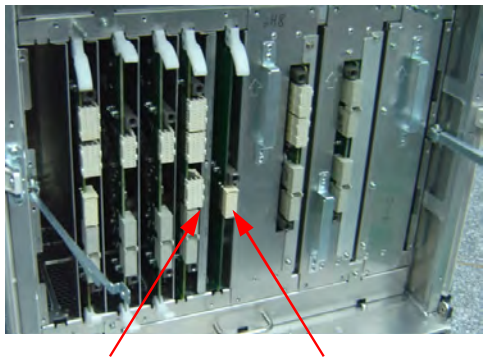
4. Pull upwards the handle and remove the Communication Mother Board Assembly from the main unit box.

5. Hold the handle and pull out the Communication Mother Board Assembly.

6. After removing Communication Mother Board Assembly, unscrew one M3X8 screw to open the retainer of board.



7. Open the retainer, as shown in the figure, wrench one plastic spanner outwards, to a certain position, and then the board can be automatically loosen. Take out the signal processing board (not supporting 4D/elastography).
8. Assemble signal processing board (supporting 4D) and 4D or 4D&TEE board as shown in the figure. Insert the board into the certain position along the slot and lock the board by wrenching the up and down spanners.



NOTE:	For versions lower than 02.00.00, signal processing board (supporting 4D/elastography) is required for 4D function. You need to install both the signal processing board (supporting 4D/elastography) and the 4D board.

10.2.2.2 4D or 4D&TEE board

If there is a Signal processing board (supporting 4D/elastography) in the machine，only need to install 4D or 4D&TEE board when configuring with 4D module (referring to10.2.2.1),Then 4D can be used normally.

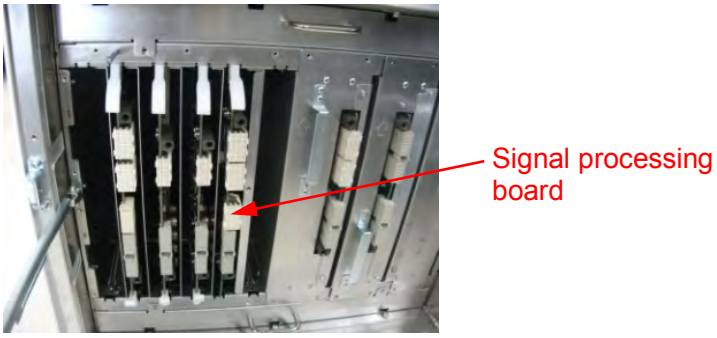
10.2.3 Elastography

1. Open Preset menu and click [System information] into the [System detailed information] in which confirm the information of Signal Processing Board. If the original board doesn't support 4D/elastography, please follow the steps to install the optional hardware:

a) Remove original Signal processing board (not supporting 4D/elastography) ， referring to

10.2.2.1 the 1~7 step;

b) Install the Signal processing board (supporting 4D/elastography) to the location as follows:

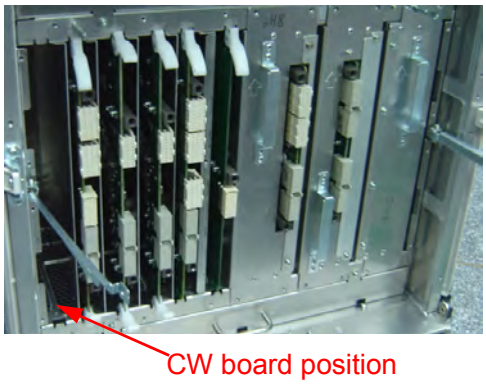


c) Install optional Key files(referring to 10.1），then elastography can be used normally.

2. If the original board supports 4D/elastography, only need to setup the soft Key file, then elastography can be used normally.

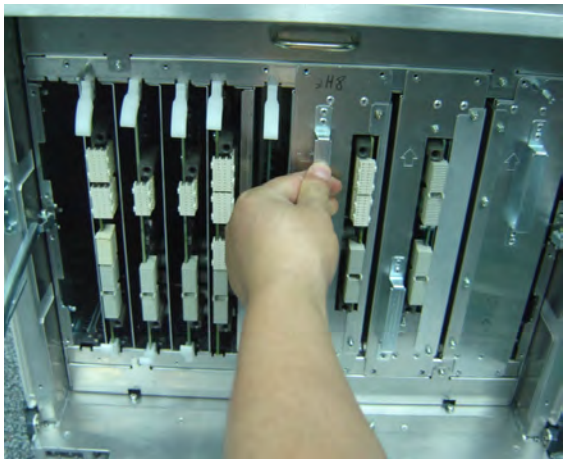
10.2.4 CW Board

1. Open the retainer. Refer to procedure 1 to 6 in 10.2.3.
2. Insert the CW board into the certain position along the slot and lock the board by wrenching the up and down spanners.

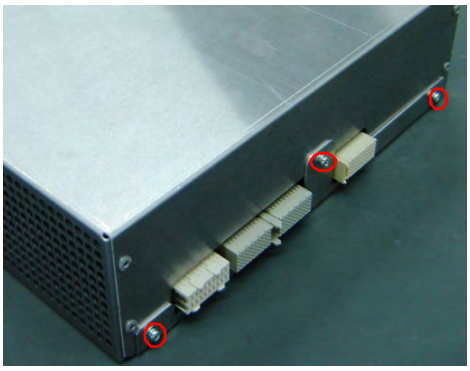


10.2.5 DVR Board

1. Refer to procedure 1 to 6 in 10.2.3.
2. As shown in the figure, hold the handle and pull the PC module assembly out.

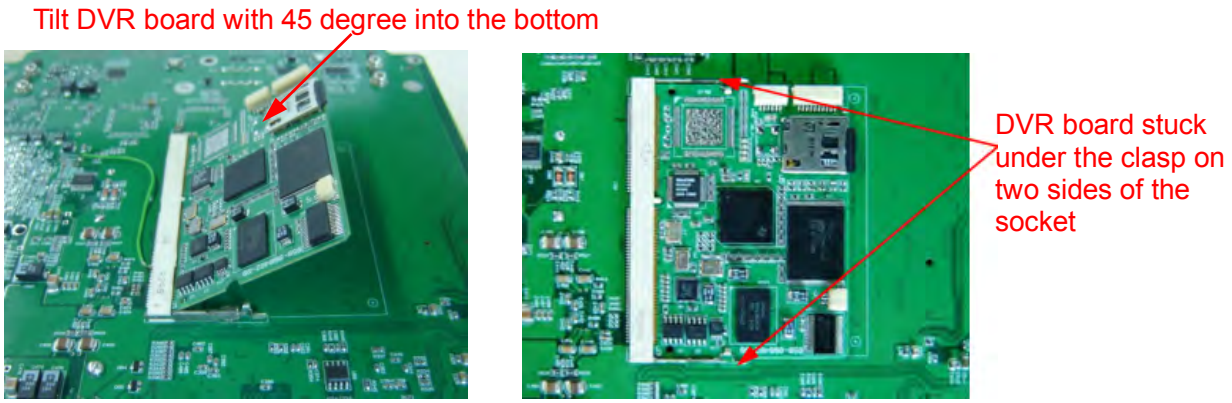


3. After removing the PC module assembly, unscrew five M3X8 screws as shown in the figure.



4. Unscrew six M3X8 screws to remove digital board assembly and CPU module.

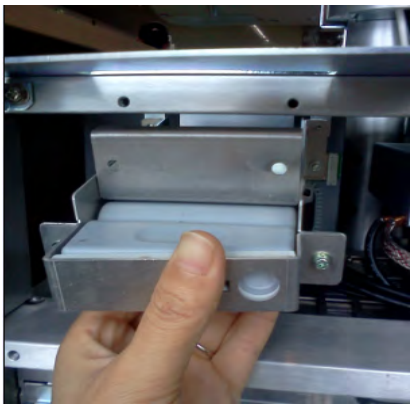
5. Put one side of radiator of CPU module downwards on the table. Tilt DVR board with 45 degree into the socket of digital board and then to the bottom turn it clockwise until it stuck under the clasp of the socket.



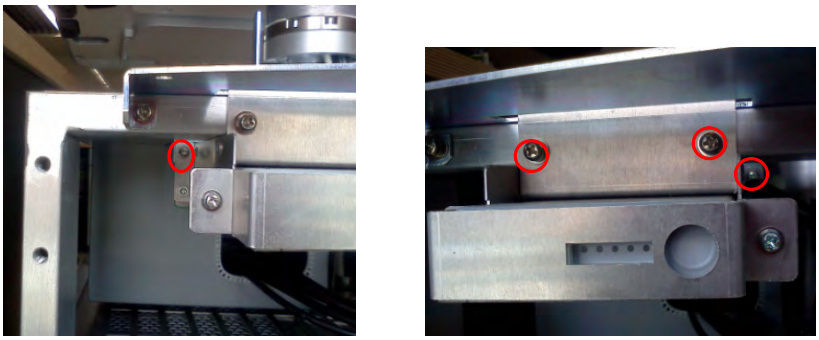
NOTE:		
	1.	Avoid touching the metal side of DVR board and protect it well.
	2.	If it is difficult for the clasp automatically opening, please open it manually and then put on DVR board.

10.2.6 Battery Assembly

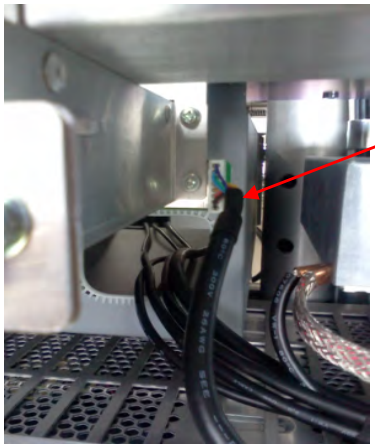
1. Remove the rear cover. Refer to procedure 1 and 2 in 9.3.3.
2. As shown in the figure, put the battery assembly on the main unit racket and up cover.



3. As shown in the figure, fix the battery assembly on the main unit racket by four M4X8 screws.



4. Plug the reserved battery connection wire on the left of DVD-R/W racket to the socket of battery connecting board.



5. Assemble the rear cover to finish the whole process.

10.2.7 Gel Warmer

1. Assemble the gel warmer under the control panel by following the direction shown in the figure.

2. Connect the gel warmer power wire to the socket under control panel to finish the assembly.

11 System Diagnosis and Support

11.1 General Status Indicator

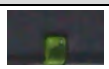
11.1.1 The Status Indicators of the Control Panel

Status indicators	Icon	Status definition and indicators
Power-on status indicator		The indicator is not on when the system is turned off; Press the key, the indicator blinks in green when the system is powered on. After power on, the indicator is green.
Battery status indicator		It illuminates in orange when batteries are charging; It illuminates in green when batteries are charged to full capacity; The battery discharges with more than 20% electricity, and the indicator is green. The battery discharges with less than 20% electricity, and the indicator blinks orange. The battery discharges with less than 5% electricity, and the indicator blinks orange quickly. When the battery is in non-charge/discharge status, the indicator is off.
AC indicator		The indicator is on green when the ultrasound system is connected to the AC power supply. The indicator is off only when batteries supplied.
Standby status indicator		The indicator blinks orange in standby status. The indicator is off on the other status.
Hard disk indicator		The indicator light blinks in green when the hard disk is reading or writing. The indicator is off automatically in other situations.

11.1.2 The Status Indicator of the Power on the IO Rear Board

Status indicators	Icon	Status definition and indicators
Digital board power supply D+12V status indicators	12	Power on, and indicator is on (green), which indicates D+12V output of the main unit box power module is normal.
Digital board power supply D+5V status indicators	5	Power on, and indicator is on (green), which indicates D+5V output of the main unit box power module is normal.
Digital board power supplyD+3V3 status indicators	3.3	Power on, and indicator is on (green), which indicates D+3V3 output of the main unit box power module is normal.

11.1.3 Monitor Status Indicator

Status indicators	Icon	Status definition and indicators
Monitor status Indicator	 At the lower right corner of the monitor	The indicator is green, normally display The indicator is orange, no video signal input, there displays “No Signal”, 15s after been powered. The indicator blinks orange, malfunction in the inverter.

11.1.4 The Status of Whole Machine

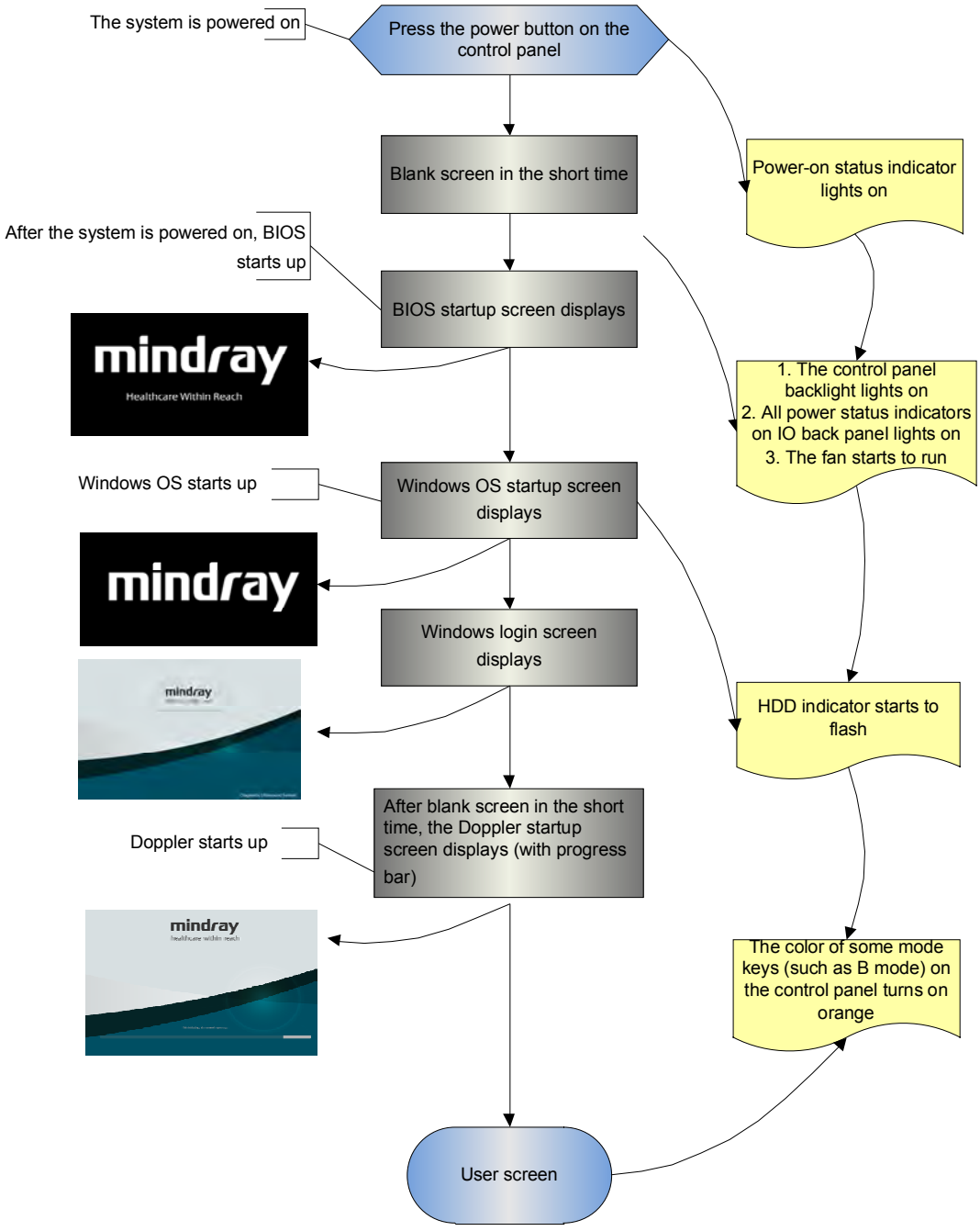
Status of whole machine	Status definition and indicators	To enter	To exit
Scanning status	The Power-on status indicator turns on green; The [Freeze] key is white or light off.	Entering or exiting the scanning status by the [Freeze] key	
Freezing status	The Power-on status indicator turns on green, and the [Freeze] key is orange	Entering or exiting the freezing status by the [Freeze] key	
Standby status	The standby indicator blinks in orange.	1. Press the power button for a short time, and then the system enters into the standby status by choosing from the status popped on the screen. 2. If there is no operation for the time set at first, the system would enter	The system restores to the freeze status after restarting by pressing the power button for a short

		into the standby status automatically.	time.
Screen-saver status	The brightness of the monitor not changes, “mindray” is rotating on the display as default and the backlight of the control panel is off. The system is frozen. Ultrasound hardware imaging system is in the dormancy mode	There is no operation for the time set at first, and then the system would enter into the screen-saver status from the freezing status automatically.	When you press any key on the control panel, the system would return to the freeze status, both the brightness and the backlight of the control panel restore to the previous status.
Power-off status	The system is on the power-off status, when connected the AC power supply, the AC indicator is on, else refer to the instruction of “Battery status indicator”	Press the power button for a short time, and then the system is turned off by choosing from the status popped on the screen	Starting the system by pressing the power button for a short time

11.1.5 Status Indicator of Gel Warmer

Status indicator	Icon	Status definition and indicators
Ultrasound Gel Warmer Double-color indicator	 Locates in the right of the warming control switch	1. Green: the gel warmer is powering and working normally; 2. Orange: abnormal working status.

11.2 Start-up Process of the Whole System


The system is powered on
Press the power button on the control panel
Blank screen in the short time
Power-on status indicator lights on
After the system is powered on, BIOS starts up
BIOS startup screen displays
mindray
Healthcare Within Reach
1. The control panel backlight lights on
2. All power status indicators on IO back panel lights on
3. The fan starts to run
Windows OS starts up
Windows OS startup screen displays
mindray
Windows login screen displays
HDD indicator starts to flash
After blank screen in the short time, the Doppler startup screen displays (with progress bar)
Doppler starts up
The color of some mode keys (such as B mode) on the control panel turns on orange
User screen

11.2.1 Complete System AC Power on process

Basic operation	Process and Status
Connect system power plug into main power supply.	AC power indicator on the minor panel is on. Battery indicator is on (if there is battery). Hard disk indicator and standby indicator are off.
Press the power button on the control panel.	Power-on status indicator blinks in a short time and then it is on normally.

Powered on completed.	1. Backlight of control panel is on. 2. Monitor indicator is on. 3. Fans run.
Hardware is initialized and logic is configured. PC enters into BIOS process.	Display black screen.

11.2.2 BIOS Start-up Process

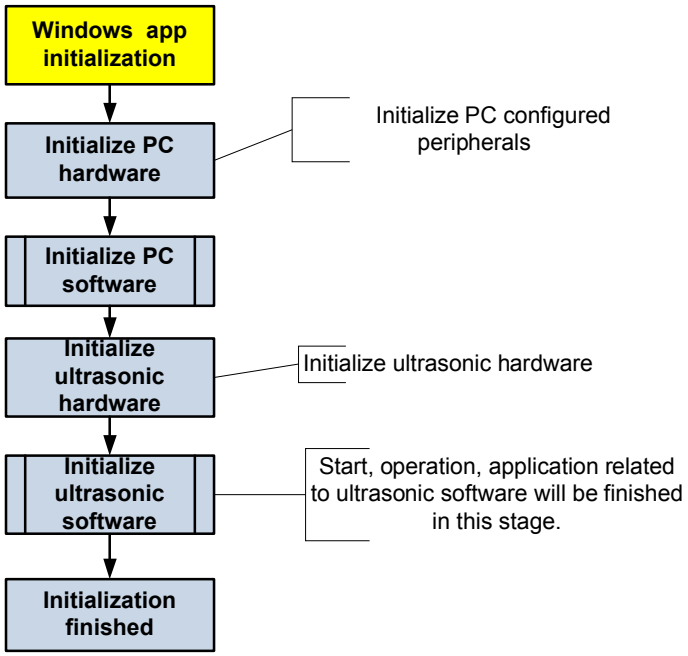
Basic Process	Basic Status definition
Self-test after the system power-on	Black screen but short time.
Initialization & Record the setting value& Runtime program	Display BIOS start-up screen.
Load the operating system	Display BIOS start-up screen during the loading. After loading, it is black screen and then turn to WINDOWS start-up screen.

11.2.3 Windows Start-up Process

Basic Process	Basic Status definition
Lead program loading	Black screen but short time.
Detect and configure hardware	Black screen but short time.
Internal core loading	Mindray Logo appears.
User login	As above.
Start DOPPLER	Mindray Logo page appears and information display in progress bar.

11.2.4 Doppler Start-up Process

11.2.4.1 Start-up Process


Windows app initialization
Initialize PC hardware
Initialize PC configured peripherals
Initialize PC software
Initialize ultrasonic hardware
Initialize ultrasonic hardware
Initialize ultrasonic software
Start, operation, application related to ultrasonic software will be finished in this stage.
Initialization finished

11.2.4.2 Details

Process	Detailed operation	Step	Procedure	Possible reasons for start stop
No prompt	Windows starts. Appmon starts Doppler. Bind configuration file path. Set Windows property. Initialize display device, main window and USB related devices. Start bus devices: Backbone Dev and LPC. Initialize time and multi-lingual processing function. Initialize external file system, net and CD/DVD driver. Enumerate external port. Configure timer; Initialize SWI; Build maintenance server and configure system static data. Configure system font. Load information organization. Initialize UI manager and UI icon data.	7	Power on and configure hardware and Windows system.	
Initializing hardware…	Load start-up graphics and display progress bar. Parse configured factory data. Maintain data server.		Start-up graphics.	/
Loading system preset…	Create local setting and system setting server.	1	Configure presetting data.	

Process	Detailed operation	Step	Procedure	Possible reasons for start stop
Loading common exam preset…	Create public data manager of exam modes.	1		
Loading exam preset...	Create measurement preset, peripherals, net, KMP packet and net storage preset server.	4		
Initializing locale…	Set regional information, language, font library and input method. Create controller factory. Build GUI layer. Set menu item. Initialize function library. Create UICenter.	1	Configure hard disk data.	/
Initializing gui…	Build application layer. Initialize keyboard board. Create access control management and remote desk control.	1	Pay attention to the keyboard.	/
Initializing ultrasound peripheral…	Configure dialog box. Initialize print library. Monitor battery PHV. Load print task icon. Build low power consumption. Build USB manager and RW manger. Initialize movie playback device.	1	Configure peripherals and pay attention to the battery.	/
Initializing ultrasound image…	Create ECG RD thread. Set virtual machine and then initialize it. Create front and back end object tree (ultrasys etc.)	2	Pod data	/
Initializing ultrasound application…	Add the function package of measurement menu. Register application port of measurement patient	1	Patient info database	/
Initialization completed…	Create patient info manger (UpatientApp)	1		/
/	Enter into Doppler	1	Doppler screen	/

11.3 Warning and Abnormal Information

The machine has alarm function. When the malfunction exists in the machine, an alarm dialog box will be popped up, and the LOG file generated will be saved in the system log, which will be in the directory of D: \DC8\Log\. The detailed description of alarm information is as follows:

NOTE:	In the LOG: *** refers to the time, in the format as 2011-6-12 14:15:15.

11.3.1 Battery Alarm

Alarm Tips	LOG Record	Measure
Battery communication fails The battery capacity displayed is not correct or the current battery can't be used	*** Battery I2C error	Check the battery connection or replace the battery
None	*** Battery I2C error, Shutdown State	Check the battery connection or replace the battery
The battery will be out of power, please replace quickly!	*** battery cycle is 301, please change the battery	Replace the battery
Battery is abnormal, abnormally discharge.	*** battery break	Replace the battery

11.3.2 The Voltage of System Power Alarm

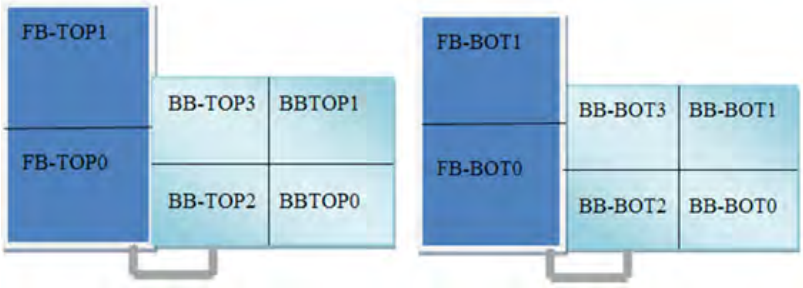
Alarming tips	LOG record	Measure
The real-time battery will be out of power, please replace quickly!	*** System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]~[HHH]V	Replace the button battery
none	*** System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage: [LLL]-[HHH]V. [XXX] represents voltage name, [VVV] represents the current value, and [LLL]-[HHH] represents the lower and upper limits. The voltage names respectively are: Back-end power supply: D+12V, D+5V, D+3V3, D+2V5, D+1V8, D+1V2, D-5V, D-12V Front-end power supply: A+5V7, A+4V, A+3V3, A+2V5, A+1V8, A-12V, A-5V7, A+19V	1. If one of the power is abnormal (over-low or over-high) in the front-end power supply, try to change the front-end power board. 2. If one of the powers is zero in the front-end power supply, refer to the table in 4.8.5; try to change the corresponding board in front-end. 3. If power in back-end (D+12V, D+5V, D+3V3, D-5V, D-12V) is over-low or over-high, try to change the back-end power board. 4. If power in back-end (D+2V5, D+1V8, and D+ 1V2) is over-low or over-high, try to change the digital board.

11.3.3 Temperature Alarm

<table>
<tr><th>Alarming tips</th><th>LOG record</th><th>Measure</th></tr>
<tr><td>Temperature alarming, XX
Shut down
(XX means inversion timing, starting from 60S)</td><td>*** System Monitor: Temperature Alert! [XXX], Current temperature: [VVV] ℃, Limit temperature: [LLL]-[HHH] ℃.
[XXX] refers to the temperature name, [VVV] refers to the current value, [LLL]~ [HHH] refers to the upper and lower limits, temperature names are: T_ACDC, T_BDCDC, T_DSP, T_4D, T_RX, T_CW, T_FDCDC1, T_FDCDC2
<table>
<tr><th>Heat area</th><th>Temperature name</th><th>He t area</th><th>Temperature name</th></tr>
<tr><td>AC-DC board</td><td>T_ACDC</td><td>Front-end main unit box RX board</td><td>T_RX</td></tr>
<tr><td>Back-end power board</td><td>T_BDCDC</td><td>Front-end main unit box CW board</td><td>T_CW</td></tr>
<tr><td>Front-end main unit box DSP board</td><td>T_DSP</td><td>Frontal-end power board</td><td>T_FDCDC1
T_FDCDC2</td></tr>
<tr><td>Back-end main unit box 4D or 4D&TEE board</td><td>T_4D</td><td></td><td></td></tr>
</table></td><td>Check the fan log (if the fan stops working)/check if the heating condition is normal.</td></tr>
<tr><td>None</td><td>***: System Monitor: Temperature Alert! [CPU thermal sensor , Current temperature: [VVV] degree, Limit temperature: 95 degree
[VVV] refers to the current value.</td><td>CPU over-temperature (level 1)
The measure is the same as above</td></tr>
<tr><td>Temperature alarming, XX
Shut down
(XX means inversion timing, starting from 60S)</td><td>***: System Monitor: Temperature Alert! [CPU thermal sensor , Current temperature: [VVV] degree, Limit temperature: 100 degree
[VVV] refers to the current value.</td><td>CPU over-temperature (level 2)
The measure is the same as above</td></tr>
</table>

11.3.4 Fan Alarm

Alarming tips	LOG record	Measure
Fans need maintenance, please contact service engineers	*** System Monitor: Fan alert！[XXX], Current speed : [VVV] rpm, Limit speed: [LLL] rpm [XXX] refers to the fan name, [VVV] refers to the current value, [LLL] refers to the limit value. Fan names are: FS_BB_TOP0, FS_BB_TOP1, FS_BB_TOP2, FS_BB_TOP3, FS_BB_BOT0, FS_BB_BOT1, FS_BB_BOT2, FS_BB_BOT3,	Replace the fan/connect the line again/remove the malfunction

	FS_FB_TOP0, FS_FB_TOP1, FS_FB_BOT0, FS_FB_BOT1 “FS_FB” refers to big fan; “FS_BB”refers to the small fan. Fan locations are shown as follows:  Top fan Bottom fan	

11.3.5 PHV Alarm

Alarming tips	LOG record	Potential reason
None	*** +100V Power supply voltage error, the voltage is [LLL]V ,normal region is 95.000V to 105.000V [LLL] refers to the voltage	+100V over-voltage or zero
	*** -100V Power supply voltage error, the voltage is [LLL]V ,normal region is -95.000V to -105.000V [LLL] refers to the voltage	-100V over-voltage or zero
Alarm! High-voltage transmission is abnormal, and images can’t display normally!	*** [XXX] supply voltage error, [XXX] is [LLL] V (upper limit is 80.000V [XXX] refers to the high-voltage name, they are: PHV1P, PHV1N, PHV2P, PHV2N [LLL] refers to the current value.	PHV1+/PHV1-/ PHV2+ /PHV2- over voltage
Alarm! High-voltage transmission is abnormal, and images can’t display normally!	*** UPhvMonitor: phv hardware warning: FAIL_HV&PHV	Malfunction on the front-end power main board
	*** PHV protect, PHV1P:[VVV]V,PHV1N:[LLL]V,PHV2P:[PPP]V,PHV2N:[AAA]V [VVV], [LLL], [PPP], [AAA]V refer to different voltages.	PHV1+/PHV1-/PHV2+/PHV2- is zero

11.3.6 Gel Warmer Abnormality

Abnormality	Potential Causes	Suggestion
Green indicator is off	Damage of internal component or abnormality in microcontroller program.	Unplug and reconnect the power cord to observe if the green light is on; if not, change a new gel warmer.

The status indicator blinks in orange in a frequency of 0.5 Hz.	The gel warmer is not able to heat due to the damage of internal components.	Unplug and reconnect the power cord to observe if the orange light blinks in frequency of 0.5Hz; if yes, change a new gel warmer.
The status indicator blinks in orange in a frequency of 2Hz.	Overheating protection due to damage of internal components.	Disconnect the power cord and wait about 10 minutes for the cooling of the gel warmer, reconnect the power cord, start to heat, wait about 10 minutes before the gel warmer becoming warm, and observe if the orange light blinks in frequency of 2 Hz; if yes, change a new gel warmer.
The status indicator lights in green, but the gel warmer is not warm at all	Failure in the internal electrical connection.	Disconnect and reconnect the power cord, start to heat, wait about 10 minutes and touch the gel warmer to see if it is warm; if not, replace a new gel warmer.

11.3.7 Other Alarms

Alarming tips	LOG record	**Measure**
"SystemConfiguration.ini" can't be opened, please check the HDD data!	None	Reinstall the OS
ADT7462 initialization is abnormal	XXX ADT7462 initialization error: XXX ADT7462, details are: PC Board A, PC Board B, PC Board A & B, Front-End Power Main Board C, PC Board A & Front-End Power Main Board C, PC Board B & Front-End Power Main Board C, PC Board A & B & Front -End Power Main Board C	Reinstall the system software/check if the drive is normal/check if the digital board is normal/check if the front-end power main board is normal.

11.4 Self-test

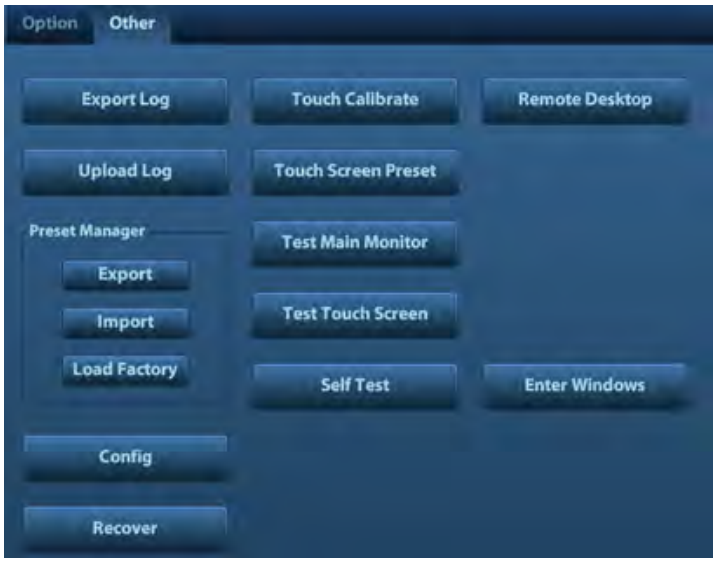
11.4.1 Introduction

The self-test system of DC8 is mainly used to test the connectivity and running status of hardware board in machine, According to different authorities and checking contents, there are three self-test types including manufacturer self-test, maintenance self-test and user self-test. This chapter mainly describes maintenance self-test and user self-test.

11.4.2 Maintenance Self-test

NOTE:	Before entering into system test, you should wait for some time until all the Doppler operations are finished, or it may lead to no self-test response. After turning on the system, You had better enter into system test by starting the self-test software directly.

1. When changing account, you may log on the system by entering Service password and the Customer Service Department account.
2. Click [Maintenance] on [Setup] menu. In [Other] page click [Self Test].



3. Enter into the system self-test screen as follows.

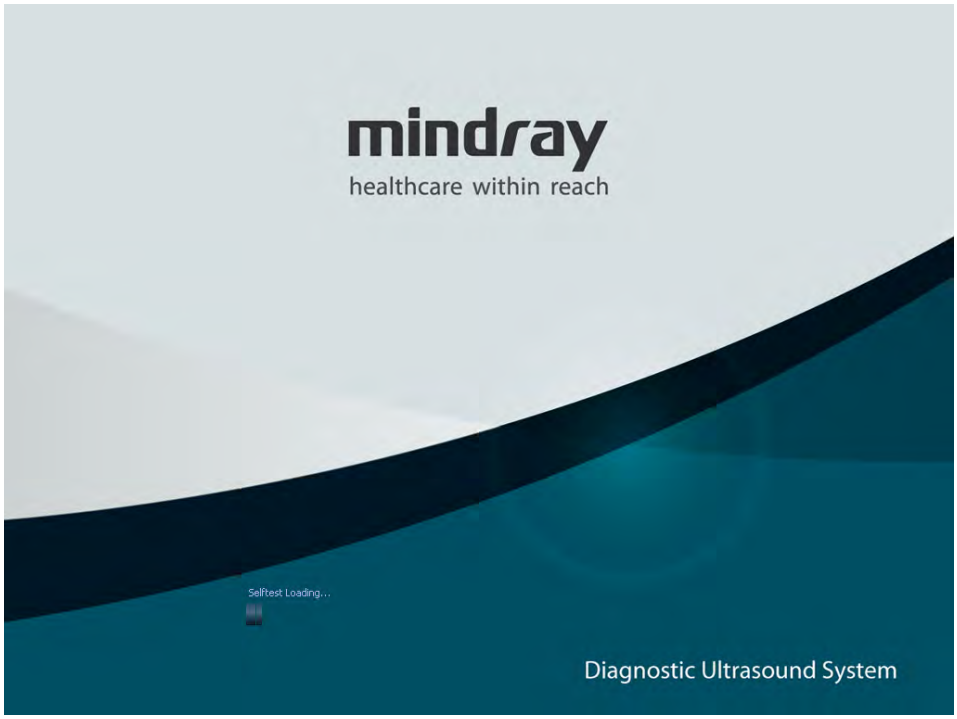


Fig 11-1 Booting screen of the self-diagnosis system

4. On the Main interface of maintenance self-diagnosis system, you can preset the corresponding test items, then click [Start] to enter into the maintenance self-test status.

Button	Function
[Open All]	Click [Open ALL] to unfold all test items
[Close ALL]	Click [Close ALL] to fold all test items
[Default]	Click [Default] to automatically select all the items to be tested by default
[Select ALL]	Click [Select ALL] to select all test items
[Select None]	Click [Select None] to cancel all test items
[OnFail]	There are two options, “Continue” and “Stop”. If you select “Continue”, the test will continue even though a test item fails during testing; however if you select “Stop”, the test will stop once a test item fails during testing.
[Start]	Click [Start] to perform tests for checked items one by one, while the button turns to “Stop”. During the testing, if you click “Stop”, the test will stop. After the test is completed, the “Stop” button turns to “Start”, waiting for the next test.
[Next Fail]	After the test is completed, if you click [Next Fail], the procedure will look for the next failed test item from the Messages list, of which test information will display in the first low of the list. If test information display from the first low to the last low of the list, the procedure will automatically start to query from the first test information
[Clear History]	Click [Clear History] to clear test terms and the results in messages list, and recover the system chart to the initial status.
[Loops]	Perform loop test, if it is checked and the loop test number is input at the right side, the test will be performed as many as the number you set. If the loop test number is less than 0, the loop test will not perform until the user stops testing or the test will stop once a test item fails during testing.

[Quit]	Click [Quit], the system will exit the test interface, and then enter into the self-test result interface.
Note: In the region of test, the testing items are divided into parent items according to boards and there are several sub items for each parent item. The testing items can be customized according to requirements. If the check box before an item is selected (☑), this item is in the testing list; contrariwise, if the check box before the item is deselected (☐), this item is not in the testing list. When a parent item is selected, all the sub items of this item are selected by default; contrariwise, when deselecting a parent item, all the sub items of this item are deselected by default.	

Note:

The main interface of self-diagnosis system includes three types: manufacturing, maintenance and user interface. The self-diagnosis interface of manufacturing is similar with the self-diagnosis interface of maintenance, which can be divided into 5 regions.

Fig 11-2 Maintenance self-test screen

5. Display of the Self-diagnosis Status

When the program is running, the version and issued date will be displayed on the left side of the status bar: Sapphire Self-test Software for Manufacture Version：xx; Release Date：YYYY-MM-DD. During the test, the software version in the status bar will turn to the name of the item on test. And the test progress of current item and the total test progress are also displayed in the status bar.

Besides, the remaining test time will also be displayed.

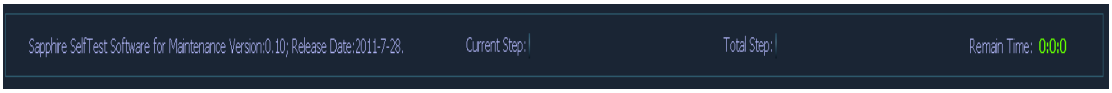


Fig 11-3 Sketch Map of Status Bar

6. Monitor information bar

Monitor information bar displays the current time, CPU occupancy ratio, memory occupancy ratio, temperatures of CPU1, CPU2, CPU3, CPU4, DSP board, receiving board, AC-DC power board, back-end power board, front-end power board.

When the temperature exceeds the working temperature, the temperature will be displayed in red, the temperature range is set by the system configuration, for details, please refer to C:\DC8\exe\main \SystemConfiguration.ini on the system.

7. Test information

When the tests are finished, the results will be displayed. For the tests, the passed items will be marked with PASS in green, and the failed items will be marked with FAIL in red; and if the items are not selected, they will be marked with Skip in gray. See the figure below:

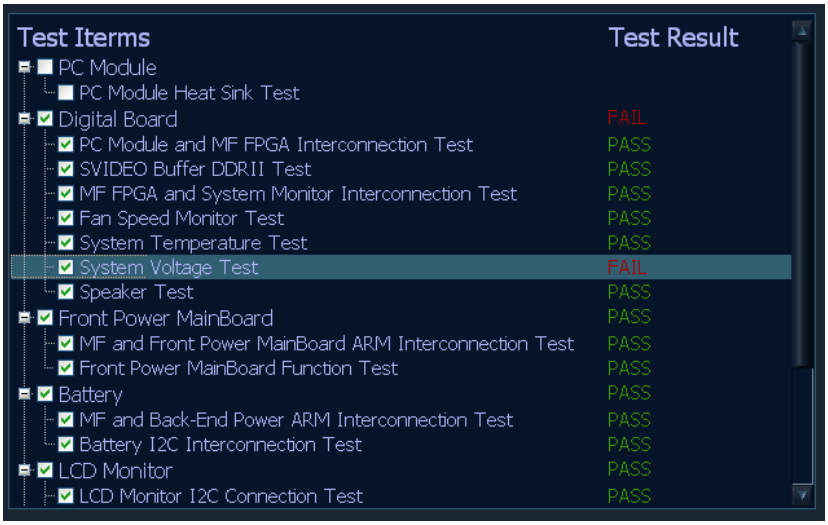

Test Iterms
Test Result
PC Module
PC Module Heat Sink Test
Digital Board FAIL
PC Module and MF FPGA Interconnection Test PASS
SVIDEO Buffer DDRII Test PASS
MF FPGA and System Monitor Interconnection Test PASS
Fan Speed Monitor Test PASS
System Temperature Test PASS
System Voltage Test FAIL
Speaker Test PASS
Front Power MainBoard PASS
MF and Front Power MainBoard ARM Interconnection Test PASS
Front Power MainBoard Function Test PASS
Battery PASS
MF and Back-End Power ARM Interconnection Test PASS
Battery I2C Interconnection Test PASS
LCD Monitor PASS
LCD Monitor I2C Connection Test PASS

图 11-4 Test items in the table

Click the test items in Test items, the system will show the details of the test results. See the figure below:

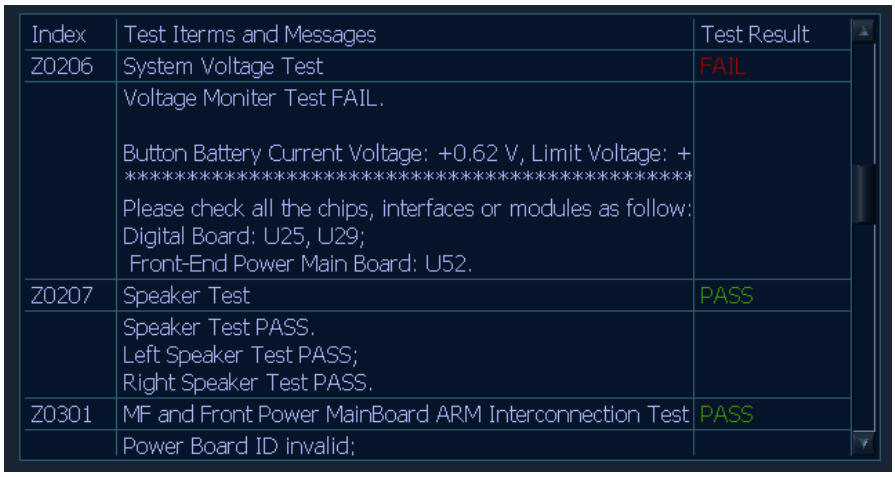


图 11-5 Test results in Messages

The test items will be automatically indexed, the format is ZXXYY，they are begin with Z, XX is the sequence number in the first level of the item. YY is the sequence number in the second level of the item. E.g., System Voltage Test, the index number is Z0206, 02 means the second test item in the first level for Digital Board, 06 means the sixth test item in Digital Board for System Voltage Test.

8. When the self-test is finished, the test results will be displayed as follows (this interface only used for displaying the test results, only available to the production person and service engineer).

Test Result
Test Iterms
Test Result
Message
PC Module
PC Module Heat Sink Test
Skip
Digital Board
PC Module and MF FPGA Interconnection Test
PASS
PC Module and Multifunction FPGA interconnection test PASS;
Multifunction logic version:0x11061710;
Multifunction logic build version:0x00090;
Multifunction logic release time:2011.6.17;
Digital Board ID:1.0.0.
SVIDEO Buffer DDRII Test
PASS
Digital Board SVIDEO DDRII Test PASS;
MF FPGA and System Monitor Interconnection Test
PASS
Multifunction FPGA and ADT7462 interconnection test PASS;
Fan Speed Monitor Test
PASS
Fan Test Pass.
System Temperature Test
PASS
System Temperature Test PASS.
The Temperatures of AC-DC Power Board, Back-end Power Board, DSP Board, Receiver Board, Fr
Power MainBoard Point 2 ,CPU 1 and CPU 2 are in the range.
System Voltage Test
FAIL
Voltage Moniter Test FAIL.
Button Battery Current Voltage: +0.61 V, Limit Voltage: +2.30~+3.80 V.
Speaker Test
Skip
Front Power MainBoard
MF and Front Power MainBoard ARM Interconnection Tes
PASS
Power Board ID invalid;
Power Board firmware version: 0.14.
Front Power MainBoard Function Test
PASS
+100V power voltage test PASS(+100.28 V);
-100V power voltage test PASS(-100.25 V);
PW Mode PHV control test PASS.
Battery
MF and Back-End Power ARM Interconnection Test
PASS
Battery is on site;
Battery I2C connection test pass.
Battery I2C Interconnection Test
PASS
Battery is on site;
Battery I2C connection test pass.
Battery voltage is:12413mV.
Battery temperature is:27.7 C.
Battery Runtime remain time is:8355587 min;
Average remain time is:8355587 min.
Battery capacity is:99%.
Battery charge and discharge time is:2.
Test Result Save Location
Save Result
Shut Down

Fig 11-6 Test result screen

9. When self-test is finished, click [Test Report Save Location], select [Save Result] to save the results, and then click [Shut Down] to shut down the system.

Item	Meaning
Test Report Save Location check box	Displays all the removable storage media connected to the system (e.g., USB disk, removable hard disk), the check box can't be selected during the test. If there is no storage media, click the check box, the system will ask the user to insert storage media.
Save Result button	Save the test data to the selected directory, the button can't be used during the test or if no storage media is selected.
Shut Down button	Close the program, and shut down the system. If the test report is not saved, the system will ask the user if to save the report to storage media.

11.4.3 User Self-test

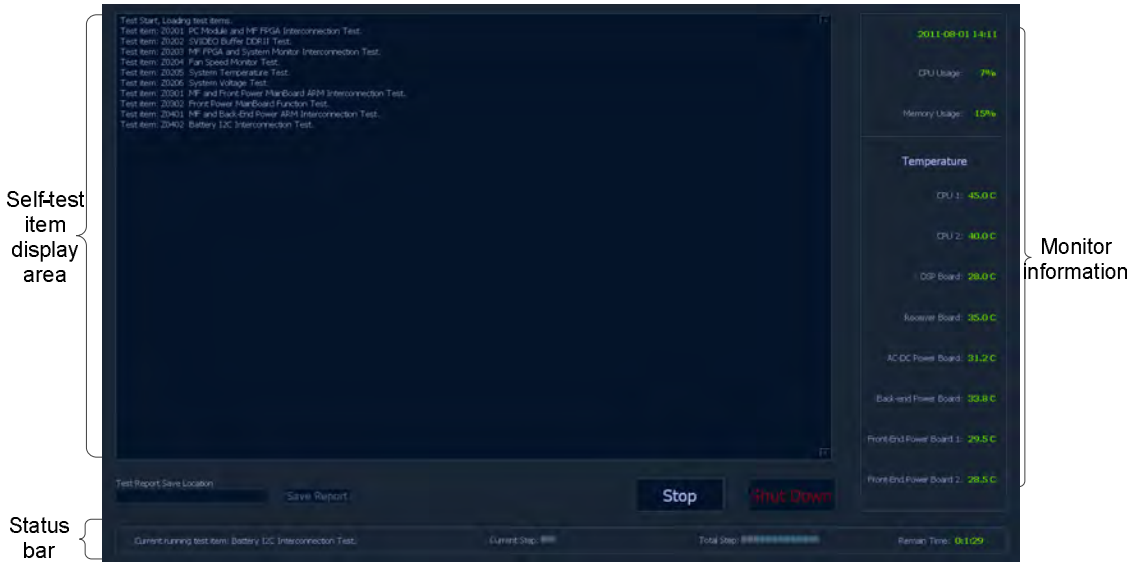
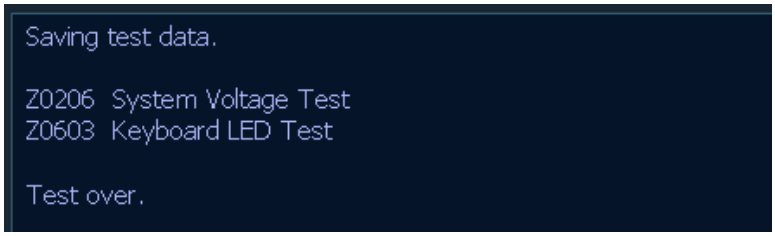


Fig 11-7 User Self-test Screen

Self-test screen are divided into three regions: self-test item display area, monitor information bar and status bar. Of which, the functions of the monitor information bar and status bar are the same as the user interface. The self-test item display area only displays the tested items; test results will not be displayed.

Item	Meaning
Start/Stop button	Click the button to test the selected items one by one, meanwhile, the button changes into [Stop]. Click [Stop] during the test, the test will be stopped, and the button changes into [Start] again, waiting for the next test.
Test Report Save Location check box	Displays all the removable storage media connected to the system (e.g., USB disk, removable hard disk), the check box can't be selected during the test. If there is no storage media, click the check box, the system will ask the user to insert storage media.
Save Report button	Save the test data to the selected directory, the button can't be used during the test or if no storage media is selected.
Shut Down button	Close the program, and shut down the system. If the test report is not saved, the system will ask the user if to save the report to storage media.

Test will begin directly when the user Self-test begins. When the test is finished, and if there has any failed item, the system only shows the failed test item. For example, if Z0206 System Voltage Test and Z0603 Keyboard LED Test failed, the system will give out the following information.

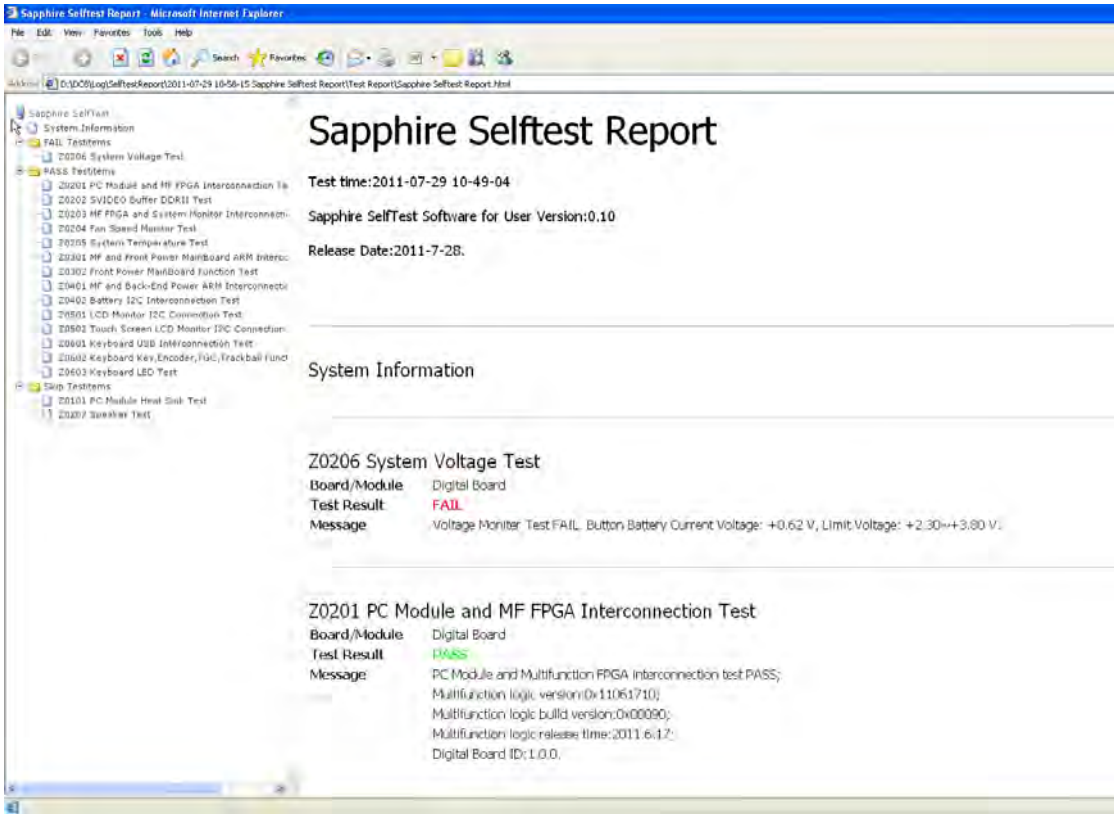


Only if all the test items past, the system will show the PASS dialogue box.

11.4.4 Test Report

11.4.4.1 Test Forms

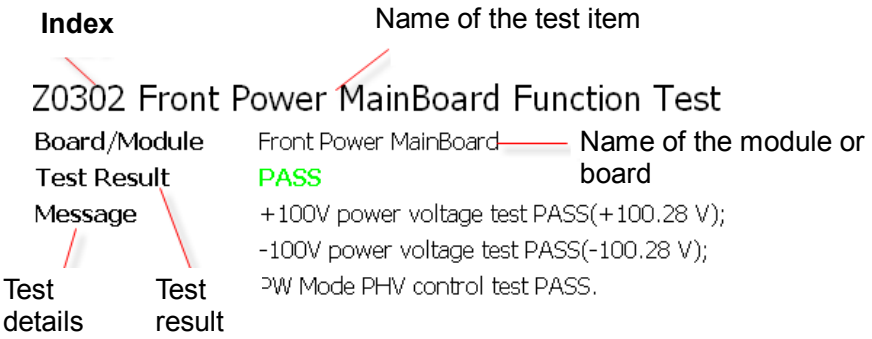
Test form is in the format of HTML, it can be opened by IE, and the format is as follows:


Sapphire Selftest Report - Microsoft Internet Explorer
Sapphire Selftest Report
Test time:2011-07-29 10-49-04
Sapphire SelfTest Software for User Version:0.10
Release Date:2011-7-28.
System Information
Z0206 System Voltage Test
Board/Module Digital Board
Test Result FAIL
Message Voltage Monitor Test FAIL. Button Battery Current Voltage: +0.62 V, Limit Voltage: +2.30~+3.80 V.
Z0201 PC Module and MF FPGA Interconnection Test
Board/Module Digital Board
Test Result PASS
Message PC Module and Multifunction FPGA interconnection test PASS;
Multifunction logic version:0x11061710;
Multifunction logic build version:0x00090;
Multifunction logic release time:2011 6:17:
Digital Board ID: 1.0.0.

The test items are listed in the left side, which are classified according to the test results. Except the test items, there also has system information. Test data and images are shown in the right side.

Click the test item in the left side, the test data will be indexed automatically.

The format of the test data is shown as follows:



11.4.4.2 Save the Test Data

Only the result of the last test can be saved. It is named by the time in format of *.zip.

The report is saved to D:\DC8\Log\SelftestReport, the maximum times is 20.

◆ **Non-loop test**

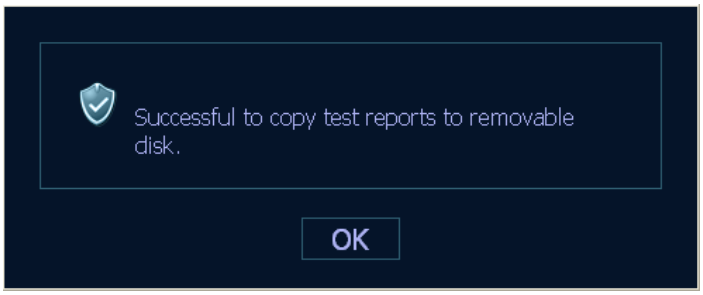
For non-loop tests, the results are saved in D:\DC8\Log\SelftestReport, one report in one zip file.

◆ **Loop test**

For loop tests, the results are saved in D:\DC8\Log\SelftestReport, N reports are saved in one zip file (Test Report Loop_N), the results are PASS or FAIL, N refers to the test times.

11.4.4.3 Export the Test Data

1. Connect the USB disk or removable storage media to the USB port on the system.
2. Select the disk, click [Save result] to save the data, the file name is Test Report. The system will show the following information.



3. For self-test details, please refer to Appendix C.

NOTE:	If there is no storage media connected, the data can't be exported.

12 Care & Maintenance

12.1 Overview

The following procedures are recommended.

12.1.1 Tools, Measurement Devices and Consumables

Table 12-1 Tools and Measurement Devices

Tool/Measurement Devices	Qty.	Remarks
Resin or plastic container	1 pcs	Can accommodate two probes
Soft brush	1 pcs	About a toothbrush size
Small plastic basin	1 pcs	Used to fill the soapy water
Safety test analyzer	1 pcs	Refer to appendix A
Inner hexagon wrench	2 pcs	Inner hexagon wrench 8 and 6

Table 12-2 Consumable List

Consumable	Qty.	Remarks
Aluminum foil	About 1 meter	
Physiological saline	About 1000ml	Filling a half container Immerging the whole probe (referring to appendix A). (concentration 0.85 ～ 0.95%)
Mild soapy water	About 400ml	
Dry soft cloth/cotton cloth	About 5 pcs	

12.1.2 Care and Maintenance Items

Table 12-3 Maintenance Items

NO.	Maintain content	Frequency	Method
1.	Clean dust-proof covers	Once a month	Referring to12.2.1
2.	Clean monitor and touch screen	Once a month	Same as the above

NO.	Maintain content	Frequency	Method
3.	Clean trackball	Once a month	Same as the above
4.	Clean control panel and minor panel	Once a month	Same as the above
5.	Clean probes (the head)	Every time after using	Same as the above
6.	Clean probe cable and the surface of connector	Once a month	Same as the above
7.	Clean holders (including probe holder and gel holder)	Once a month	Same as the above
8.	Clean cover	Once a month	Same as the above
9.	Clean peripherals	Once a month	Referring to12.2.2
10.	Check surface of probes	Once a day	Referring to12.3.1
11.	Check power cable , plug and circuit breaker	Once a month	Referring to12.3.1
12.	Check battery	Once a year	Referring to12.3.1
13.	Check function of peripherals and options	Once a year	Referring to12.3.3
14.	Mechanical safety inspection	Once a year	Referring to12.3.4
15.	Electrical safety inspection	Once a year	Referring to appendix A

12.2 Cleaning

12.2.1 Clean the System

12.2.1.1 Flow of Cleaning

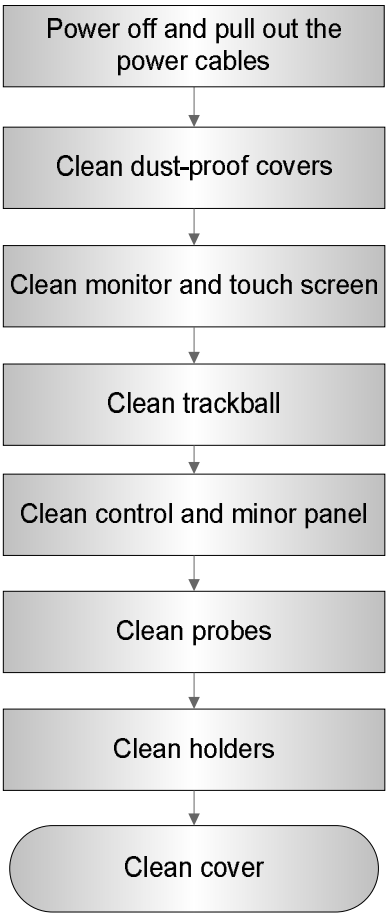


Fig 12-1 Cleaning maintenance flow

⚠**WARNING:**	**Before cleaning the system, be sure to turn off the power and disconnect the power cord from the outlet. If you clean the system while the power is "On", it may result in electric shock.**

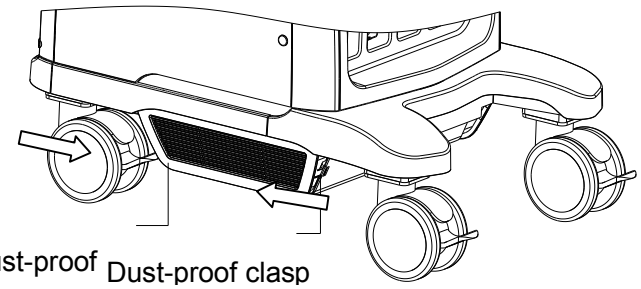
12.2.1.2 Content

1. Clean dust-proof covers

- Tool: Soft brush
- Method:

a) Disassemble dust-proof cover before cleaning.

System dust-proof cover: Grab the lower side of the dust net frame, and then pull out the net.

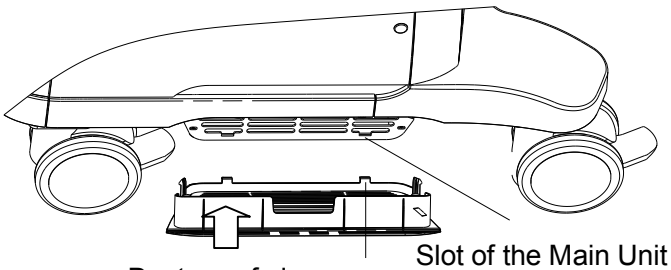


Probe port dust-proof cover: there are 4 probe ports at the front of the system, on which there is a dust-proof cover. Pull it out.

b) Cleaning: with soft brush and then wipe off the dust.

c) Assemble dust-proof covers.

Input the dust-proof clasp into the slot of the main unit, push the dust-proof inward until the dust-proof clasp is strucked in the slot.



⚠CAUTION:	**Please clean all dust-proof covers of the system periodically (1 time per month); otherwise, system damage may result. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.**

2. Clean Monitor and Touch Screen

- Tool: soft dry cloth ,clear water or soapy water
- Method:

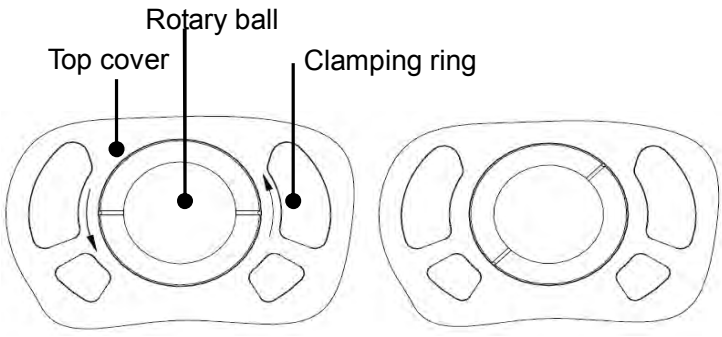
Surface of monitor and touch screen should be cleaned with soft dry cloth directly. Remained stain should be washed out by cloth with a little clear water or soapy water, and then air-dry the surface.

3. Clean Trackball

- Tool: Soft paper or dry soft cloth, soapy water
- Method:

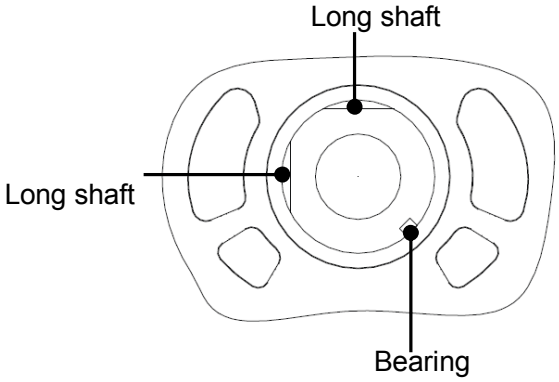
a) Disassembling the trackball:

Press the bulges on the clamping ring by both hands and turn the ring about 45° counterclockwise until it lifts. Take out the ring and the rotary ball. Be careful not to drop the ball. As shown in figure below.



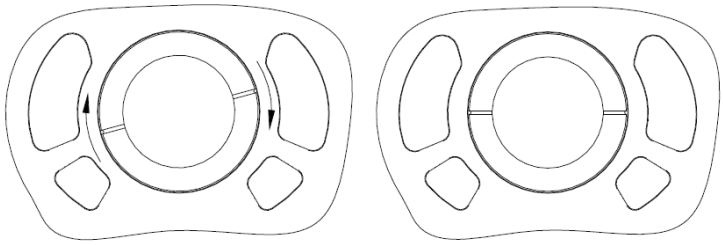
b) Cleaning：

Clean the two long shafts, the bearing, rotary ball and inside of clamping ring with clean soft dry cloth or paper.



c) Installing the trackball

Put the rotary ball back in the trackball mechanism and put the clamping ring back in (with the bulge direction of 15 ° deviated from the horizontal line), turn the ring clockwise until the bulges are flush with the top cover, and the ring clicks and locks, which means the ring is secured. See figure below.



4. Clean Control Panel

- Tools: dry soft cloth, soapy water
- Method:

Use dry soft cloth to clean the surface of control panel (including keystrokes, encoders and sliders). If the control panel is dirty, moisten the soft cloth with a little mild soapy water and wipe off any stains. Use another dry soft cloth to remove any moisture and allow all hard surfaces to completely air-dry. If it is difficult to clean the control panel, disassemble the encoder caps first and then use mild soapy water to clean it.

NOTE:	Keyboard on the control panel should be cleaned periodically; otherwise, keys maybe blocked by dirt and buzzer dings, keys don’t work.

5. Clean Probe

- Tools: mild soapy water , dry soft cloth, soft brush
- Method:

a) Wipe out the dust attached to surface of probe head, connector and cable.

b) Use soft brush to brush the dust inside probe connector gently.

c) Remained stain or dust attached to surface of cable or surface of connector should be washed out by cloth with a little soapy water, and then air-dry.

Note: Don't use cloth with water to clean the probe connector.

6. Clean Holders

- Tool: dry soft cloth , soapy water, soft brush
- Method:

Surface of power button should be cleaned by dry soft cloth. Remained stain should be washed out by cloth with clear water or soapy water (Note: cloth should not be dipped with too much water, which may cause electric shock), and then air-dry the surface.

a) Use dry soft cloth to wipe off the dust attached to inside, outside or gap of probe holder or gel holder. As to small intra-cavity probe holder or its gap, use the soft brush to brush the dust or stain.

b) Remained stain attached to inside, outside of holder should be washed out by cloth with a little soapy water and then air-dry after take it out.

c) Gel heater: Take the gel heater out after pull out the power supply cable, use dry soft cloth to wipe off the dust attached to inside and outside, then brush the dust in the ostiole of gel heater or brush the stain with a little soap water and air-dry at last.

7. Clean Cover

- Tools: dry soft cloth, soapy water
- Method:

Use dry soft cloth to clean the cover of the system. If the system is dirty, moisten the soft cloth with mild soapy water and wipe off any stains, then air-dry.

Note: Be sure to use soft brush to brush the dust attached to all the sockets or interfaces which can be seen (such as probe sockets, sockets or interfaces in IO panel and power supply panel),not the cloth with water.

12.2.2 Clean the Peripherals

Do the cleaning maintenance according to your actual peripheral configuration; items which are not configured can be skipped.

Table 12-4 Peripherals Cleaning List

No.	Content	Description
1.	Color and B/W video printer	First wipe off dust or stain attached to the cover of printer with soft dry cloth, then clean the inside of printer. Be sure to do the cleaning maintenance according to the operation manual if is necessary.
2.	Graph / text printer	First wipe off dust or stain attached to the cover of printer with soft dry cloth, then clean the inside of printer. Be sure to do the cleaning maintenance according to the operation manual if is necessary.
3.	Foot switch	Use soft dry cloth with a little mild soap water to wipe off the dust or stain attached to the pedals or cable of foot switch.
4.	Bar code scanner	First use soft dry cloth to wipe off dust attached to glass panel of scanner, then the dust or strain attached to cable and bracket. Be sure to do the especial cleaning maintenance according to the operation manual if is necessary.

12.3 Checking

12.3.1 General check

Table 12-5 General check list

No.	Content	Method
1.	Probe	a) Visually check to confirm that there is no crack and expansion to probe head. b) Visually check to confirm that there is no deterioration or desquamation to probe cable. c) {0Visually check to confirm that there is no bend, destroyed or falling off pins to the connector{0>
2.	Power supply cable and plug	a) Visually check to confirm that there is no wrinkles, crack or deterioration b) Manually check to confirm that there is no looseness or rupture. The connection of plug is reliable and the retaining clamp of power supply cable is effective.
3.	Circuit breaker	Manually check to confirm that the circuit breaker can be turned on or off normally.

No.	Content	Method
4.	Battery	Check the battery periodically ： a) Check if battery can be charged normally when power-on: That the current capacity is 100% or capacity increases after a short time indicates that the battery can be charged normally. It takes less than 5 minutes to increase 1% capacity when the total capacity is less than 90% and it takes more time when the capacity is more than 90%. b) Disconnect the system from the AC power supply to confirm if the system can maintain normal standby status in the battery power supply by inspecting standby status indicator, That the standby status indicator blinks in orange continually indicates that standby status is normal.

12.3.2 System Function Check

The system function checking is not required during Preventive Maintenance. Engineer or Customer may use it as part of their product Quality Assurance Program tests。

Table 12-6 System function list

No.	Content	Method
1.	B mode	Verify basic operation of B mode. Check basic software and hardware controls affecting B mode operations.
2.	Color mode	Verify basic operation of Color mode. Check basic software and hardware controls affecting Color mode operations.
3.	Doppler mode (PW/CW)	Verify basic operation of Doppler mode. Check basic software and hardware controls affecting Doppler mode operations.
4.	M mode	Verify basic operation of M mode. Check basic software and hardware controls affecting M mode operations.
5.	Measurement（2D, M, Doppler general measurement, applied measurement optional）	Scanning gray scale imaging on phantom, verify distance and area accuracy with measurement control. Verify measurement accuracy by performance test.
6.	Keyboard test	Operate keyboard test to verify if all control keys can work normally.
7.	LCD	Verify LCD display function and parameters adjustment. Refer to that of LCD checking.
8.	Software menu check	Verify software menu display function: if each operation menu and page can be accessed.
Remark：Please refer to 5.4～5.5 for details.		

12.3.3 Peripherals and Options Check

If the system is not configured with any module or peripheral, the corresponding items checking can be skipped.

Table 12-7 Options, Peripherals and Accessories Check list

No.	Content	Method
1.	Color and B/W video printer	Check if the output of video printer is normal.
2.	Graph / text printer	Check if the output of graph / text printer is normal.
3.	Foot switch	Check if the foot switch can implement the set functions according to the program.
4.	DVD-R/W	Check if DVD can work normally (write, read and pop).
5.	Bar code scanner	Check if the scanner can work normally and the output content is right.
6.	DICOM	Check if DICOM can work normally and send pictures and other data to DICOM server.
7.	ECG module	Check basic operations and verify the implementation of ECG functions.
Remark：Please refer to 5.3 for details.		

12.3.4 Mechanical Safety Inspection

Mechanical safety inspection is mainly used to check mechanical strength and mechanical function of the key assembly of ultrasonic system. The mode of test evaluation mainly is: Perform the evaluation by means of visual check and operating check, if the check result cannot pass, the system is in abnormal status now. Stop using the system and adopt proper measures. The test flow is as following:

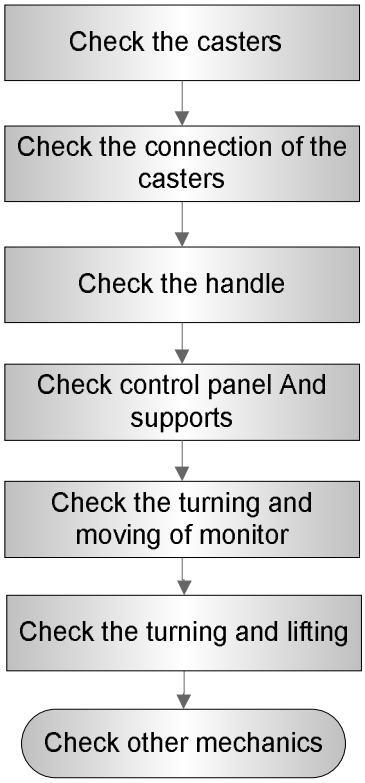

Check the casters
Check the connection of the casters
Check the handle
Check control panel And supports
Check the turning and moving of monitor
Check the turning and lifting
Check other mechanics

Fig 12-4 Mechanical Safety Inspection Flow

Table 12-8 Mechanical Safety Check

NO.	Item	Method	Tool
1.	Caster	1. Visually check to confirm there is no any crack. 2. Operate the casters to confirm the locking and releasing functions are normal.	none
2.	Connection of the caster	a) Visually check to confirm that there is no skewness and the connecting screws are free of breakage or falling off. b) Check with the spanner to make sure that there is no looseness between the caster and the base connection screw.	Inner hexagon wrench 8
3.	Handle	1. Visually check to confirm there is no any crack. 2. Hold the handle to push the ultrasound machine, and then pull it gently to confirm that the handle is free of looseness.	none
4.	Control panel and support assembly	Check by hand to confirm that the support assembly is normal and the control panel is free of skewness and looseness.	none
5.	Fixing and rotating	a) Visually check to confirm if any inclination happened to the monitor.	none

NO.	Item	Method	Tool
	mechanism of the monitor	b) Manually operate the monitor to make sure the monitor can move normally when it is turned left/ right, lifted/ lowered, and no abnormal sound exists.	none
		c) Manually turn the monitor supporting arm, the monitor can move up or down. When rotate the arm to the position, the monitor will be locked in the middle position and can't move left or right. Make sure there is no obvious looseness.	none
		d) Remove the rear cover of the control panel and neck cover of the monitor, check by a wrench to confirm that the fixing screw are free of looseness; Visually check to confirm that the cables are not scratched or clipped out that the core can be seen.	screwdriver, inner hexagonal wrench 5
6.	Turning and lifting mechanism	1. Hold the lifting arm control handle, make sure that the lifting arm can go up and down normally without abnormal sounds or phenomena 2. Hold the handle to make sure that the control panel can turn smoothly without abnormal sounds or phenomena.	none
7.	Other mechanics	Check to confirm that there is no looseness to other mechanical parts, no crack to cover and no conductive parts show in sight.	none

12.3.5 Electrical Safety Inspection

Only technical professionals or engineers after training can perform electric safety inspection.

Please refer to appendix A: Electrical Safety Inspection for details.

13 Troubleshooting of Regular Malfunctions

13.1 Troubleshooting When System Can't Be Powered on

13.1.1 Module or Board Related

No.	Descriptions	Remarks
1	Front-end power main board PCBA	
2	Front-end power auxiliary board PCBA	
3	Front-end power board PCBA	
4	AC-DC assembly	
5	Back-end motherboard PCBA	
6	Digital board module	
7	CPU module	
8	Connecting board PCBA	

13.1.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Power-on status indicator	Backlight of the power button ⊙/○
2	AC power indicator	Located on minor panel ~
3	Three Power indicators	12V, 5V, 3.3V, located on IO board

13.1.3 Troubleshooting When System Can't Be Powered on

No.	Failure Description	Cause Analysis	Measure
1	Circuit breaker tripping	Malfunction on the AC-DC power	Replace AC-DC assembly

2	AC indicator is off	1.AC power is not input; 2.Malfunction on the AC-DC power	1.Check the connection of AC power 2.Replace AC-DC assembly
3	AC indicator is ON. Power-on status indicator: After pressing power button, the indicator doesn't flash or is off. Power supply status indicator: indicators 3.3V, 5V and 12V are all off.	90% malfunction may be on the back-end power board PCBA.	Replace back-end power board PCBA
4	AC indicator is ON. Power-on status indicator: press power button, the indicator keeps flashing. Power supply status indicator: indicators 3.3V, 5V and 12V are all off.	The power board responds to power button, but the CPU module cannot respond on-off of power module. 90% malfunction may be on the CPU module.	Replace the CPU module.

13.2 Troubleshooting When System cannot be started up

13.2.1 Module or Board Related

No.	Descriptions	Remarks
1	Digital board module	
2	CPU module	
3	HDD assembly	

13.2.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Character and progress status during the starting of the system	
2	Warnings and prompts during the starting of the system.	
3	Control panel backlight status.	
4	Display indicator	

13.2.3 Troubleshooting When System cannot be Started

No.	Failure Description	Cause Analysis	Measure
1	Backlight status is normal when power on the control panel but the LCD is blank screen, displaying “NO Signal”	The system can be powered on normally, and then enters into BIOS self-test stage, but no BIOS display screen, which indicates the failure of the CPU module.	Replace CPU module.
2	BIOS start-up graphics is normally displayed, but it cannot be kept on	CPU Module malfunction	Replace the CPU module.
3	System warns “OPERATING SYSTEM NOT FOUND”	If OS loading failed, HDD or the root directory of OS is damaged.	First restore OS or else replace the HDD.
4	LCD is blank screen after entering BIOS start-up graphics	If OS can’t keep on loading, the directory of HDD may be damaged	First restore, or else replace the HDD.
5	Doppler start-up graphics is normally displayed, but it cannot be kept on	If Doppler can’t keep on loading, the directory of HDD or HDD may be damaged	First restore, or else replace the HDD.

13.3 Troubleshooting for Image Displaying

13.3.1 Module or Board Related

No.	Descriptions	Remarks
1	Front-end power main board	System power supply
2	CW board PCBA	CW mode
3	Receiving board PCBA	Receiving physical channel 128.
4	Transmission board PCBA	Transmission physical channel 128.
5	Signal processing board	Signal processing
6	Probe board assembly	

13.3.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Image feature, including dark strips and noise	The following two tables show the image features and the related description.
2	Image features when contact occurs between different types of probe and the different probe sockets.	

3	Imaging characteristics of all models of probes when connecting on the same or different ports	There may be some relay switching is damaged when replacing the transducer or the array of the transducer
4	Main Voltage Test in self-test	
5	ATGC Function Test in self-test	
6	AFE Noise Test in self-test	
7	AFE Digital Interface Test in self-test	
8	Digital Board and DSP Board Interconnection test in self-test	
9	DSP Board and Transmission Board Interconnection test in self-test	
10	DSP Board and Receiving Board Interconnection test in self-test	
11	DSP Board and CW Board Interconnection test in self-test	

13.3.3 Troubleshooting for Image Displaying

No.	Failure Description	Cause Analysis	Measure
1	No image echo in the ultrasonic image region, but probe can be recognized.	PHV voltage output is 0V or abnormal; Malfunction on the transmission board, front-end power main board or probe board.	Malfunction probability on the transmission board is bigger than that of front-end power main board PCBA. The third is probe board. Replace transmission board, front-end power main board or probe board to confirm the malfunction.
2	Dark strips on B image	Probe malfunction, e.g. array damage. Confirm it by connecting another probe.	Replace the transducer.
		If dark strips appear in the near field. only one strip or distribute regularly May be some transmission channels can’t generate transmission waveforms.	Replace the transmission Board
		If dark strips appear in the far field. only one strip or distribute equivalently; There may be failure on the receiving channels, for example, some channel cannot receive or generate echo signals.	Replace the receiving board.
		If dark strips appears casually for one probe with different sockets Malfunction may be on probe board.	Replace the probe board assembly.

3	Noise on the B image	Probe malfunction; Confirm it by connecting another probe.	Replace the transducer.
		Other electrical equipments working in the same electrical network may interfere the system. Some ripple wave on the image.	Confirm the cause of failure by turning off all electrical equipments around working in the electrical network or connecting to the system

13.4 Probe Socket System Related Malfunction Troubleshooting

13.4.1 Module or Board Related

No.	Descriptions	Remarks
1	Probe board PCBA	
2	4D or 4D&TEE board PCBA	

13.4.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Probe recognition of all models of probes when connecting on the same or different ports	
2	Probe board ID of the system	

13.4.3 Probe Socket System Related Malfunction Troubleshooting

No.	Failure Description	Cause Analysis	Measure
1	Probe can't be recognized	This probe can't be recognized when connected to all probe sockets, while reorganization of other probes is normal. Probe malfunction.	Replace the transducer.
		This probe can't be recognized when connected to a certain socket. Probe board malfunction.	Replace the probe board assembly
		No probe can be recognized on any probe port; Probe board ID can't be read correctly by the system information; Probe board malfunction.	Replace the probe board assembly

13.5 IO System Related Malfunction Troubleshooting

13.5.1 Module or Board Related

No.	Descriptions	Remarks
1	DSP board PCBA	
2	CPU module	
3	IO BOX board PCBA	

13.5.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Working condition of each USB port and USB device	Refer to USB distribution
2	Audio Test in self-test	
3	Microphone Interface Test in self-test	
4	Working condition of Video, S-video and VGA video ports	Refer to figure 6.5
5	Printing condition of video printer	Check if output of connected video printer is normal

13.5.3 IO System Related Malfunction Troubleshooting

No.	Failure Description	Cause Analysis	Measure
1	Monitor displays normally; No video printer output when press <Print> on control panel; Image printing can be performed by operating the printer directly	Remote printing control failure; As video print is controlled directly by the digital board, the malfunction may be caused by digital board or cable connection failure.	Check the cable connection, and if the cable is connected well, then replace the digital board.
2	Monitor displays normally; No video printer output when press <Print> on control panel; Image printing can't be performed by operating the printer directly	Video output malfunction, connect the printer to the other Video port, if neither of the two port works, then the malfunction may be on the digital board.	Replace the digital board or video printer inside connecting cable
		If only Video port output on the IOBOX is abnormal, the malfunction is on the digital board.	Replace the digital board or video printer inside

		If video printer inside cannot work normally, but the VIDEO port on the IOBOX is normal. The malfunction may be the signal line or connecting cable.	connecting cable
3	No sound on the two speakers Audio test in self-test: Fail	Malfunction is on the digital board	Replace the digital board
4	Only one speaker has no sound. Audio test in self-test: Fail	Malfunction on speaker	Replace the speaker
5	Microphone is abnormal. Microphone interface test in the self-test: Pass	If there is on something wrong with Microphone the malfunction may be on digital board.	Replace digital board.
6	USB device can't be recognized by USB port	Other USB port connected devices work normally. The two USB ports on the IOBOX board can't be used, USB HUB malfunction on the IOBOX.	Replace IOBOX board.
7	Network is disconnected or abnormal	First, check if it was caused by network or problem with setting , if no, malfunction on the IOBOX board or CPU module	Replace the IOBOX board or CPU module to confirm the reason.
8	WIFI cannot be recognized.	Check the 3.3V indicator on the IOBOX board, if it is darker than the indicators around or off, then the malfunction is on the digital board.	Replace the digital board.
		First, check if it was caused by network or problem with setting , if no, malfunction on the WIFI board or digital board	Replace the WIFI board or digital board to confirm the reason.

13.6 Control Panel Malfunction Troubleshooting

13.6.1 Module or Board Related

No.	Descriptions	Remarks
1	Top Cover of Keyboard Assembly	

13.6.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Backlight of control panel	To confirm if the control panel is powered normally
2	Key volume of the keys on control panel.	To confirm if the buzzer works normally.
3	Function key operation response on the control panel	
4	Function key operation response on the control panel (Digital keyboard)	It can be confirmed the malfunction is on the retractable keyboard or on the control panel PCBA.
5	Trackball operation response	
6	TGC slider bar operation response	It can be confirmed the malfunction is on the slider potential device or on the control panel PCBA.
7	Encoder operation response	It can be confirmed the malfunction is on encoder or on the control panel PCBA.
8	Control panel self-test	Support malfunction diagnosis

13.6.3 Control Panel Malfunction Troubleshooting

No.	Failure Description	Cause Analysis	Measure
1	Buzzer alarms	Key blocked	Check the control panel for key block
2	Part of the keys can't be used normally	Malfunction may be on keyboard PCBA or Silicon key	Replace the keyboard PCBA. Or Silicon key
3	Part of the keys of digital keyboard can't be used normally	Keyboard malfunction	Replace the digital keyboard assembly.
4	Trackball can't be used normally	Dust or foreign object blockage in the groove.	Clean the groove.
		Trackball speed and response time in the system preset are not correct.	Set the trackball speed and response time to a proper value.
		Trackball performance degraded.	Replace the trackball.
5	All keys of control panel are normal, Single encoder is failure.	Single encoder malfunction	Replace the corresponding encoder board
6	All keys of control panel are normal, Single key of TGC is failure.	TGC board malfunction	Replace TGC board

	All keys of TGC are failure.	Control panel malfunction	Replace Control panel

13.7 LCD and Display Malfunction Troubleshooting

13.7.1 Module or Board Related

No.	Descriptions	Remarks
1	Monitor assembly	
2	Digital board	
3	CPU module	
4	IO BOX board PCBA	
5	10.4 inch display assembly	

13.7.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	Display assembly status indicator	Located at the lower right corner of the display.
2	Backlight of the display	The effect is evident in a darker environment.
3	Video output port such as VGA, DVI on the IO back board	Need to connect with a display.
4	The display displaying status	Blank screen, or the screen warns “No Signal”, or snowflakes are displayed on the screen.
5	10.4 inch display assembly displaying status	Blank screen, or the screen warns “No Signal”, or snowflakes are displayed on the screen.

13.7.3 Display Related Troubleshooting

No.	Failure Description	Cause Analysis	Measure
1	Control panel can be powered normally; Blank screen; Display indicator flashes in yellow.	Monitor malfunction	Replace monitor assembly.
2	Control panel can be powered normally; The color of some mode key turns on orange.	The display power line malfunction or may be the power line connection is not good. May be the monitor malfunction	Check the connection or replace the monitor.

	Blank screen; Display indicator is off.		
3	Control panel can be powered normally and no key indicator turns on orange Warns “No Signal”; Display indicator is yellow.	No DVI signal input, 10.4-inch display works normally. DVI signal line malfunction or may not be connected well; or the malfunction may be on the digital board.	Check the field site, replace the digital board.
		No DVI signal input to the display, no display on the touch screen, the malfunction may be on the CPU module.	Replace the CPU module.
4	LCD displays normally; 10.4-inch display is blank screen	The display power line malfunction or may be the power line connection is not good.	Check the power line or replace the 10.4- inch display screen.

13.8 ECG Module Related Troubleshooting

13.8.1 Module or Board Related

No.	Descriptions	Remarks
1	ECG board PCBA	
2	DSP board PCBA	

13.8.2 Key Points Supporting Troubleshooting

No.	Key Points Supporting Troubleshooting	Remarks
1	ECG waveform characteristic	
2	ECG Module Information Read Test	Confirm if the communication is normal between the DSP board and ECG module.
3	ECG Module Self Test	ECG module self-test.

13.8.3 ECG module Related Troubleshooting

No.	Failure Description	Cause Analysis	Measure
1	ECG related function can’t be opened.	ECG module is directly powered by EDC_12V, not controlled; ECG function can’t be opened, this means ECG port serial port communication is abnormal. The malfunction may be on the ECG cable, or on the ECG module, or on the DSP board ECG	Confirm if the communication between the DSP board and ECG module is normal by self-test. Check the ECG cable and Replace ECG module to find

		serial port related circuit. Generally speaking, ECG malfunction possibility is big.	the reason.
2	Open the corresponding function, and the waveform is displayed as a line or the waveform is abnormal.	ECG leads are abnormal or ECG module is abnormal.	Find the reason by ECG self-test; Replace ECG leads or ECG module to find the reason.

Appendix A Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PRO$_{XL}$ International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe such as Fluke, Metron, or Gerb may require modifications to the procedure. Follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

ELECTRICAL SAFETY INSPECTION

1- Power Cord Plug

TEST PROCEDURE	
◆ The Power Plug	
The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.
◆ The Power Cord	
The Power Cord	No physical damage to the cord. No deterioration to the cord. --For devices with detachable power cords, inspect the connection at the device. --For devices with non-detachable power cords, inspect the strain relief at the device.

ELECTRICAL SAFETY INSPECTION

2- Device Enclosure And Accessories

TEST PROCEDURE	
◆ Visual Inspection	
The Enclosure and Accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No physical damage to probe head (e.g., crack)
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).
◆ Contextual Inspection	
The Enclosure and Accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

ELECTRICAL SAFETY INSPECTION

3- Device Labeling

TEST PROCEDURE

Check the labels provided by the manufacturer or the healthcare facility is present and legible.

- *Main Unit* Label
- *Integrated Warning* Labels
- *Slope and High Voltage Caution* Label
- *Don't Stress* Label

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

VOERVIEW

Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or Protective Earth Metal enclosure or equipotential terminal. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

TEST PROCEDURE

◆ Prepare

1) First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).

2) Connect the test lead(s) between the RED input jack and the GREEN input jack.

3) Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.

4) If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

◆ Warning

During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.

◆ Perform the Test

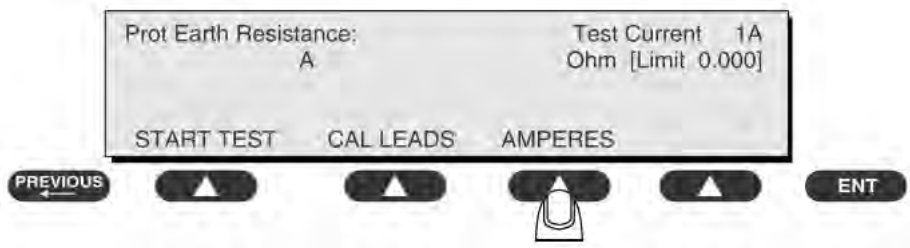
1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an

exposed metal area.

3) Press shortcut key 3. The Protective Earth Resistance test is displayed.

4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



5) Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.

6) Press the print data key at any time to generate a printout of the latest measurement(s).

◆ Note

When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.

◆ Failure

Once it reaches the limitation, stop using equipment. Check the protective earth connection between Protective Earth terminal and Protective Earth Metal enclosure and equipotential terminal; Retest and inform the Customer Service Engineer for analysis and disposal if still fail.

LIMITS

ALL COUNTRIES R = 0.2Ω Maximum

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

OVERVIEW

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

Leakage current is measured the following ways:

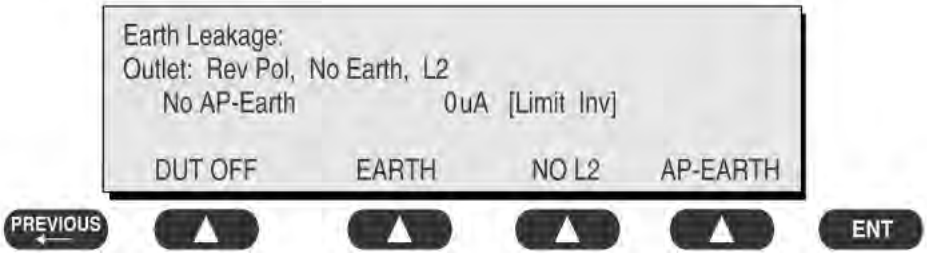
- Earth Leakage Current, leakage current measured through DUT outlet Earth
- Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

TEST PROCEDURE

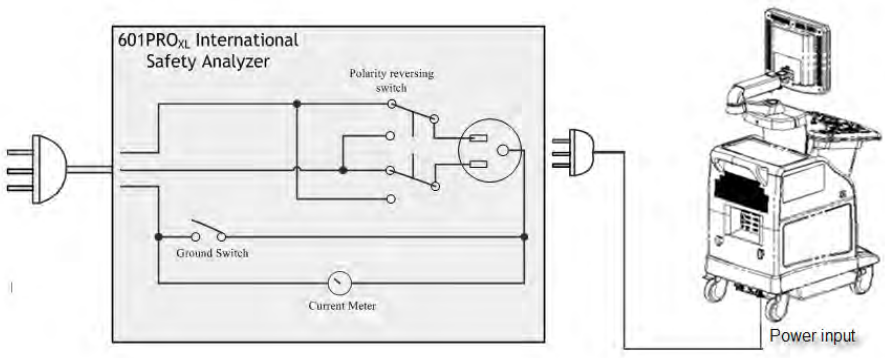
◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the device's applied parts to the 601PRO applied part terminals if applicable.
3) Press shortcut key 4.The Earth Leakage test appears on the display, and the test begins immediately:



- SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
- SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
- SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
- SOFT KEY 4 toggles the AP to Earth to No AP to Earth.

4) Press the print data key at any time to generate a printout of the latest measurement.



ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

Figure 1 Earth leakage test

◆ Failure

Check any short-circuits of the Y capacitor on power unit. Replace a new one if any portion defective.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect mains wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect mains wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation cannot be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

UL60601-1：	300 μA Normal Condition
	1000 μA Single Fault Condition
IEC60601-1:：	500 μA Normal Condition
	1000 μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

OVERVIEW

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

Normal Polarity, Earth Open, Outlet ON	Normal Polarity, Outlet ON
Normal Polarity, L2 Open, Outlet ON	Reversed Polarity, Outlet ON
Reversed Polarity, Earth Open, Outlet ON	Reversed Polarity, L2 Open, Outlet ON

◆ Warning

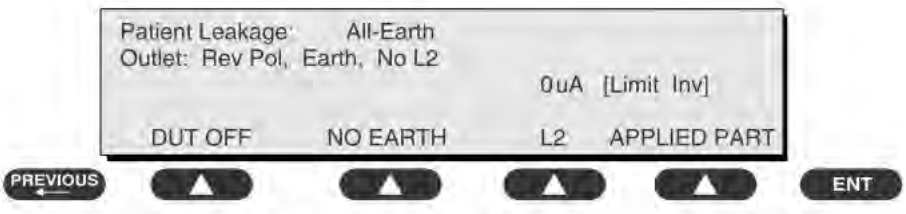
If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.

2) Attach the applied parts to the 601PRO's applied part terminals.

3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.

5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

KEY on the 601PRO.

6) Press the print data key at any time to generate a printout of the latest measurement.

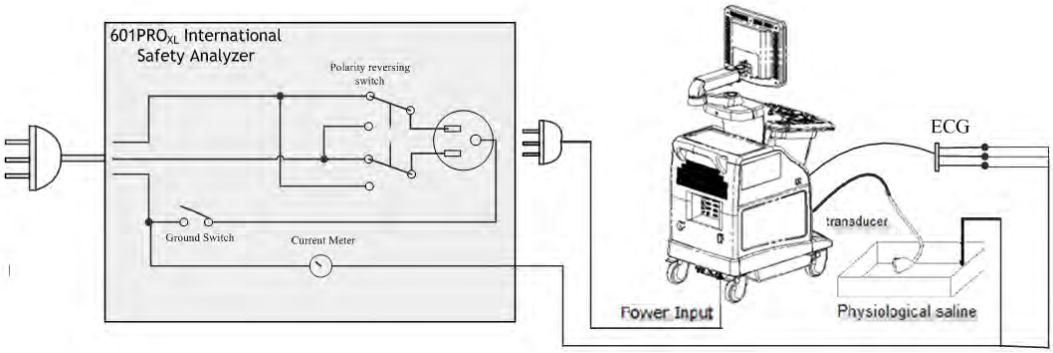


Figure 2 patient leakage Current

◆ Note

1, In addition to Probes ,Patient leakage current test should be perform if ECG or PCG parts used;

2, If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.

◆ Failure

Check any broken of the Applied parts. Replace any defective one.

Check any broken of the ECG/PCG module if used, Replace any defective one.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

All countries

For BF ECG input and transducer

100 μ A Normal Condition

500 μ A Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

The following outlet conditions apply when performing the Mains on Applied Part test.

Normal Polarity;

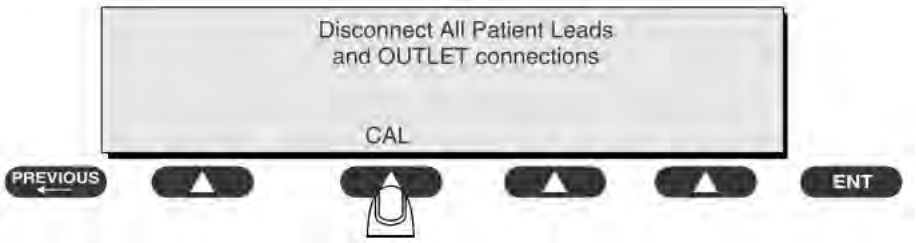
Reversed Polarity

TEST PROCEDURE

◆ Prepare

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

1) Disconnect ALL patient leads, test leads, and DUT outlet connections.
2) Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

3) When the calibration is finished, the Mains on Applied Part test will reappear.

◆ Warning

1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
2) High voltage is present at applied part terminals while measurements are being taken.

◆ Performance

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
2) Attach the applied parts to the 601PRO applied part terminals.
3) Attach the red terminal lead to a conductive part on the DUT enclosure.
4) Press shortcut key 7. The Mains on Applied Part test is displayed.

5) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
6) Press START TEST (SOFT KEY 1) to begin the test.
7) Press the print data key to generate a printout of the latest measurement.

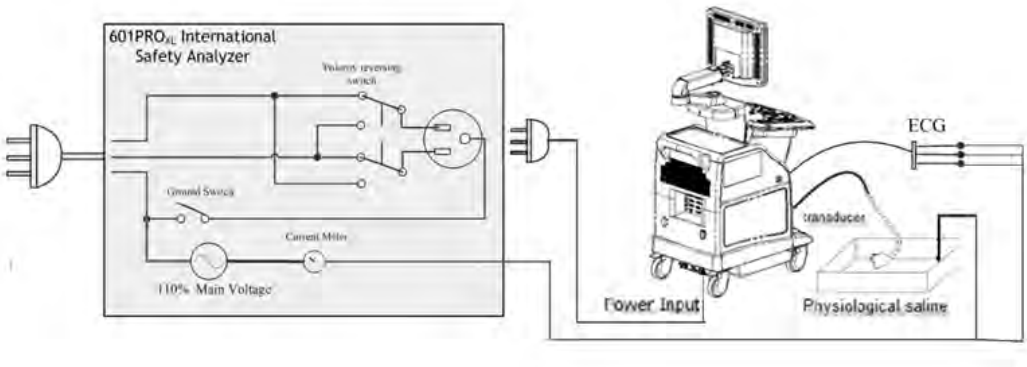


Figure 3 Mains on Applied part leakage

◆ Note

1, In addition to Probes ,Patient leakage current test should be perform if ECG or PCG parts used;

2, If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

◆ Failure

Check any broken of the Applied part. Replace any defective one.

Check any broken of the ECG/PCG module if used, Replace any defective one.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

All countries:

For BF ECG input and transducer:

5000 μ A

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

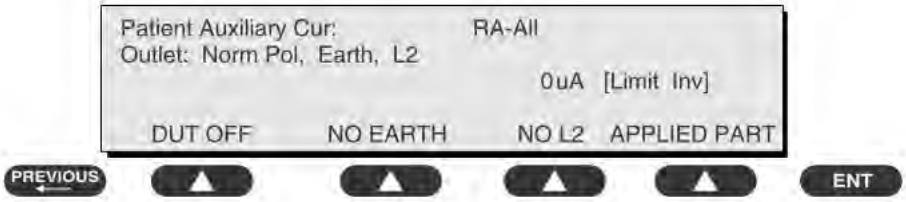
overview

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

◆ Prepare

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the patient leads to the 601PRO ECG jacks.
3) Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
4) Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



5) Press SOFT KEYS 1-4 to select leakage tests
6) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
7) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
8) Press the print data key at any time to generate a printout of the latest measurement.

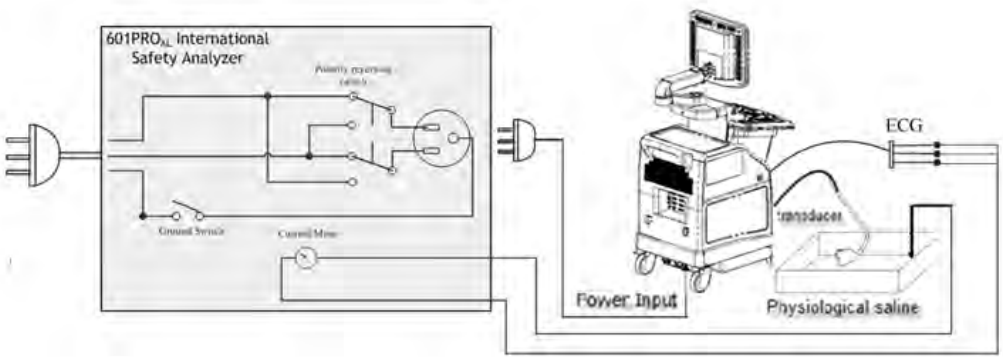


Figure 4 patient Auxiliary Current

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

◆ Note

If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.

◆ Failure

Check any broken of the AC cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation can not be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

All countries

For BF ECG input and transducer

100 μA Normal Condition

500 μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION FORM

（Class I equipment）

Overall assessment:

☐ Scheduled inspection — Test item: 1, 2, 3

☐ Unopened repair type — Test item: 1, 2, 3

☐ Opened repair type, not modify the power part including transformer or patient circuit board — Test item: 1, 2, 3, 4, 5

☐ Opened repair type, modify the power part including transformer or patient circuit board — Test item: 1, 2, 3, 4, 5, 6, 7, 8

Location:					***Technician:***	
Equipment:					***Control Number:***	
Manufacturer:		***Model:***			***SN:***	
Measurement equipment /SN:					***Date of Calibration:***	
INSPECTION AND TESTING					***Pass/Fail***	***Limit***
1	***Power Cord Plug***					
2	***Device Enclosure and Accessories***					
3	***Device Labeling***					
4	***Protective Earth Resistance***			***Ω***		***Max 0.2 Ω***
5	***Earth Leakage***	***Normal condition(NC)***		***____μA***		***Max: NC: 300μA(refer to UL60601-1) * NC: 500μA(refer to IEC60601-1) * SFC: 1000μA***
		Single Fault condition(SFC)		***____μA***		
6	***Patient Leakage Current***	***Normal condition(NC)***		***☐BF___μA***		***Max: BF applied part: NC:100μA, SFC: 500μA***
		Single Fault condition(SFC)		***☐BF___μA***		
7	***Mains on Applied Part Leakage***			***☐BF___μA***		***Max: BF applied part: 5000μA***
8	***Patient Auxiliary Leakage Current***	***Normal condition(NC)***		***☐BF___μA***		***Max: BF applied part: NC:100μA, SFC: 500μA***
		Single Fault condition(SFC)		***☐BF___μA***		

Note:

The equipment which sell to America shall comply with the requirement of UL60601-1, others shall comply with the requirement of IEC60601-1.

Name/ Signature: _____ Date:_____

Appendix B Phantom Usage Illustration

Targets Disposal of Phantom KS107BD

A1——A5： Axial resolution target group B: Blind-area target group

C： Longitudinal target group D： Horizontal target group

E: Mimic tumor F： Mimic sac (diam 10mm) and stone

G Mimic sac (diam 6mm)

4. Line Target System

There are 8 groups of nylon line targets disposed as shown in the figure.

1．A1——A5：

Axial and lateral resolution target group. The distances between the horizontal branch and the acoustic window are 30, 50, 70, 120 and 160mm, the center horizontal distances between two adjacent lines of A1 and A2 groups are 1, 5, 4, 3, 2mm, A3~A5 groups are 5, 4, 3, 2mm. The center longitudinal distances between two adjacent lines of the longitudinal branches are 4, 3, 2, 1mm.

2．B：

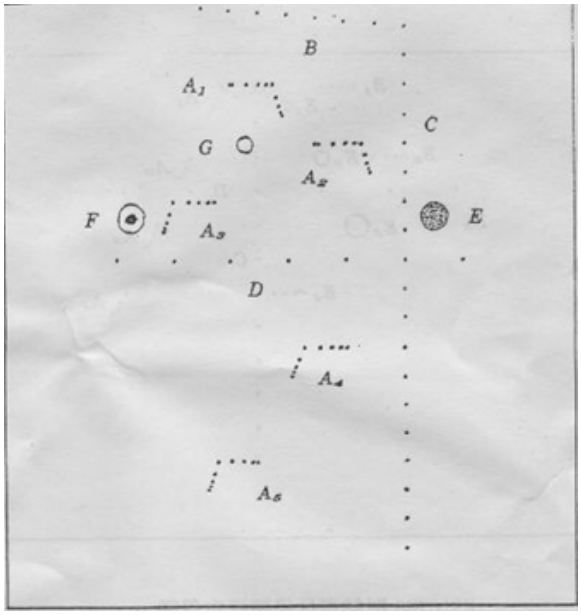
Blind-area target group. Center horizontal distance of adjacent lines is 10mm, distances to the acoustic window are 10, 9, 8, 7, 6, 5, 4, 3mm.

3．C：

Longitudinal target group. 19 target lines with a 10mm center distance between adjacent lines.

4．D：

Horizontal target group. 7 target lines with a 20mm center distance between adjacent lines.



Targets disposal- KS107BG

A1——A4 Axial resolution target group

B1——B4 Lateral resolution target group

C Longitudinal target group

D Horizontal target group

E1——E3 Mimic sacs with diameters of 2, 4, 6mm

4. Line Target System

There are 8 groups of line targets disposed in TM material as shown in the figure.

1．A1——A4：

Axial resolution target group. The upmost lines in each target locate at the depth of 10, 30, 50, 70mm, the center longitudinal distances of each group (from the top down) are 3, 2, 1, 0.5mm, and the horizontal distance is 1mm.

2．B1——B4：

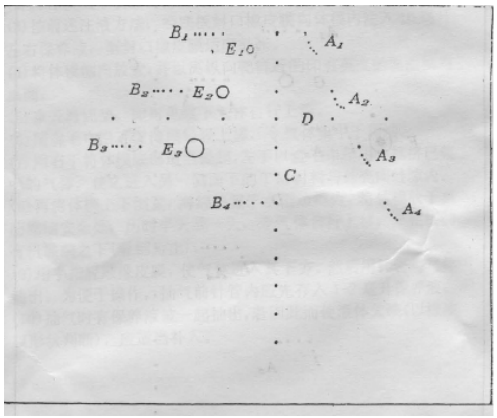
Lateral resolution target group. Locate at a depth of 10, 30, 50, 70mm, with a center horizontal distance of 4, 3, 2, 1mm in each group.

3．C：

Longitudinal target group. 12 target lines with a 10mm center distance between adjacent lines.

4．D：

Horizontal target group. Locate at a depth of 40mm, with a 20mm center distance between adjacent lines.



Appendix C Description of Self-diagnosis Test Items

C.1.1 Z0101 Hard Disk Verify

- Test Content

Traverse all hard disk files in Doppler installation directory, compare and verify the files with the achieved hard disk data.

- Analysis to Test Failure

If the verification file does not exist, the system will prompt “Failed to open the result file.” If the hard disk data is damaged, the system will prompt “The failed CRC: current verification value (failed file path, correct verification value)”.

- Suggestion to Test Failure

Restore the hard disk data, replace the CRC file in DC8 folder with the CRC_Result.txt in the restore package.

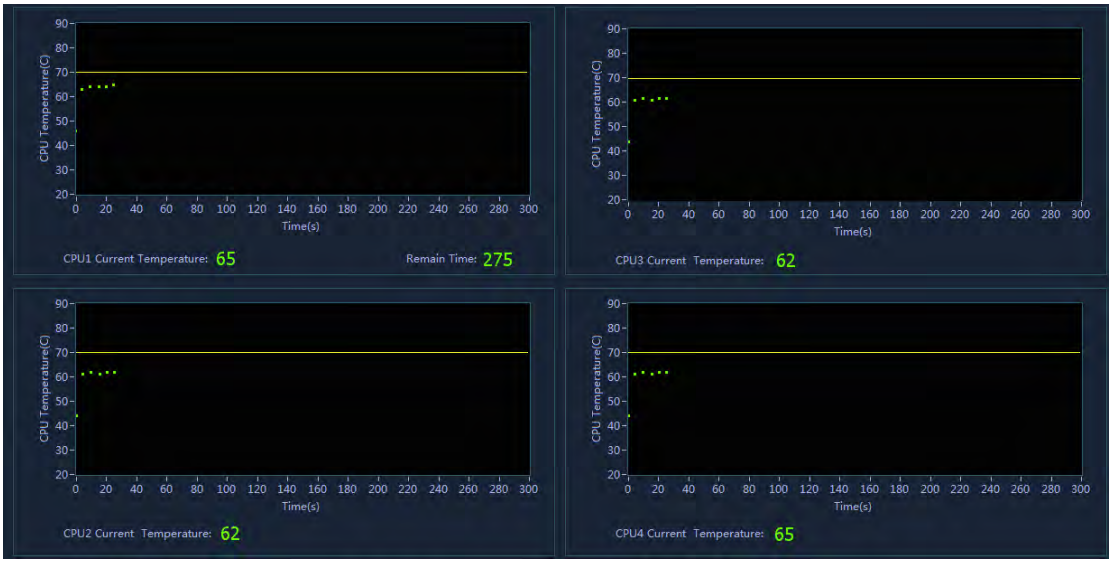
C.1.2 Z0201 PC Module Heat Sink Test

- Test Content

Test if the PC module heat sink is installed in the right way.

- Test Description

The following screen will be opened after the test is started. There displays the current CPU working temperature, the yellow line represents the highest working temperature of the CPU, and the changing wave represents the current CPU temperature. If the temperature didn’t go beyond the limit, the waveform is displayed in green; otherwise, it is red. At the bottom of the dialogue box, there display the current CPU temperature and the remaining test time.



The interface can't be closed manually after the test is started, until the test is completed. If the test failed, please turn off the power as soon as possible.

- Suggestion when test failed:

Check if PC module heat sink was correctly installed, if not, reinstalled it.

C.1.3 Z0301 PC Module and MF FPGA Interconnection Test

- Test Content

Test if the LPC communication between PC module and MF FPGA is normal.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. Replacing the digital board is recommended.

Board	Connector
Digital board	U42, J1

C.1.4 Z0302 SVIDEO Buffer DDRII Test

- Test Content

The super stratum test item: Z0201 PC Module and MF FPGA Interconnection Test

Test if SVIDEO DDR II works normally.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. Replacing the digital board is recommended.

Board	Connector
Digital board	U40, U44

C.1.5 Z0303 MF FPGA and System Monitor Interconnection Test

- Test Content

Test if two SMBUS communication between MF FPGA and three piece ADT7462 is normal. One SMBUS connects to two piece ADT7462 on the digital board, and the other connects to one piece ADT7462 on the front-end power main board.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. Replacing the digital board is recommended.

Board	Connector
Front-end power main board	U52
Digital board	U25,U29

C.1.6 Z0304 Fan Speed Monitor Test

- Test Content

The super stratum test item: Z0203 MF FPGA and System Monitor Interconnection Test.

It tests whether the12 fans inside the system work normally or rotate speed under the limit value.

- Suggestion when test failed:

Maintain the corresponding fan according to test message.

C.1.7 Z0305 System Temperature Test

- Test Content

The super stratum test item: Z0203 MF FPGA and System Monitor Interconnection Test.

Monitor if the main configured boards temperatures are normal. The limit value of system temperature is set as : C:\DC8\exe\main \SystemConfiguration.ini。

- Suggestion when test failed:

1. Check if the fan works normally; check if the following listed boards and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. Replacing boards that temperature is not normal is recommended.

Board	Connector
Digital board	U25, U29 ,Q26
Front-end power main board	U52,Q57, Q58
AC-DC power board	Q26
Back-end power board	Q12
DSP board	Q1
Receiving board	Q3
CPU module	CPU

C.1.8 Z0306 System Voltage Test

- Test Content

The super stratum test item: Z0203 MF FPGA and System Monitor Interconnection Test. Monitor if voltages of system boards are normal. Monitor the front-end voltage, back-end voltage and button battery voltage. The limit value of system temperature is set as : C:\DC8\exe\main \SystemConfiguration.ini。

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. Replacing the button battery or boards with abnormal voltage is recommended.

Board	Connector
Digital board	U25,U29
Front-end power main board	U52

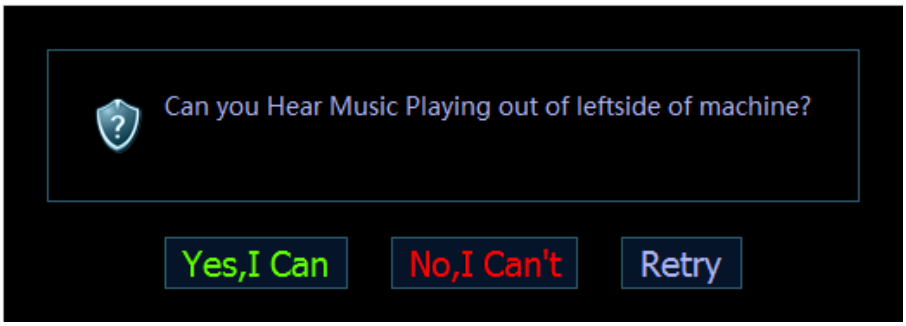
C.1.9 Z0307 Speaker Test

- Test Content

It tests whether the function of audio chip, power amplification circuit and speaker are normal.

- Test Description

During the test, the left side of machine will play out sounds, and pops up the following dialog box to ask if you can hear “Ring~~” playing out of the left side machine. If you didn’t hear it, please click “Retry” to play it again, and click “No, I Can’t”, if you still can’t hear it after trying many times. And if you heard it, please click “Yes, I Can”.



The program will control the system right side buzzer to give off sounds, and popup the dialog box to ask if you can hear “Ring~~” playing out of the right side machine as shown above. The tests for right and left side buzzers are the same.

- Suggestion when test failed:

Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally, check the speaker and cable.

Board	Connector
Digital board	U18,U27

C.1.10 Z0308 CP210x Serial Number Test

- Test Content

There are two CP210 chips on IO BOX board and DVR board. The serial number in IO BOX is 002, another in DVR board is 003. The extend port for footswitch is 001

- Suggestion when test failed:

1. If test is failed, the serial number of wrong chip will be prompted. Please check the correspondent chip. If the serial number is repeated, the device cannot recognize.
2. Check if the hardware and related circuits listed below are normal, interfaces are securely welded, modules are normal.
3. Replacing digital board is recommended.

Board	***Connector***
Digital board	***U45, U27***
IO BOX board	***U27***

C.1.11 Z0309 Serial Port Test

- Test Content

The super stratum test item: Z0208 CP210x Serial Number Test

Check if the serial port of IO BOX board works normally, the 2 pin and 3 pin should be short circuited when testing the serial channel.

- Suggestion when test failed:

If test is failed, there may be something wrong with serial port communication of IO BOX board. Replacing IO BOX board is recommended.

C.1.12 Z0310 Microphone Interface Test

- Test Content

Test if the microphone interface on the left side of control panel. Insert the MIC before the test, speak louder when testing normally. The sound wave will display on the screen. Only when sound wave over pass the setting value, the test result is “pass”.

- Suggestion when test failed:

First, you should guarantee that the MIC works normally, when you speak louder, there will be sound wave displaying on the screen. If no sound wave, the microphone interface may be failed.

1. Check if the hardware and related circuits listed below are normal, interfaces are securely welded, modules are normal.
2. Replacing digital board is recommended.

Board	*Connector*
Digital board	*U15, U20, U26, U19*

C.1.13 Z0401 MF and Front Power Main Board ARM Interconnection Test

- Test Content

The super stratum test item：Z0201 PC Module and MF FPGA Interconnection Test.
Test if communication serial port between MF FPGA and Front-end power ARM works normally.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. First recommended option is to replace the front-end power board, then the digital board.

Board	Connector

Digital board	U57, Q10, Q11, J4
Front-end power main board	J12, U12

C.1.14 Z0402 Front Power Main Board Function Test

- Test Content

The super stratum test item：Z0201 PC Module and MF FPGA Interconnection Test.

Test if the output of high voltage -/+ 100V and PHV setting is normal.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. First recommended option is to replace the front-end power board, then the digital board.

Board	Connector
Digital board	U57,Q10,Q11,J4
Front-end power main board	J12,U12

C.1.15 Z0501 MF and Back-End Power ARM Interconnection Test

- Test Content

The super stratum test item：Z0201 PC Module and MF FPGA Interconnection Test.

Test if communication serial port between MF FPGA and back-end power ARM works normally.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. First recommended option is to replace the front-end power board, then the digital board.

Board	Connector
Digital board	U58,Q12,Q13,J4
Back-end power main board	J1,U23

C.1.16 Z0502 Battery I2C Interconnection Test

- Test Content

The super stratum test item：Z0401 MF and Back-End Power ARM Interconnection Test.
Check if the I2C communication bus between the battery and back-end power management ARM works normally.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally.
2. Replacing back-end power board is recommended.

Board	Connector
Digital board	U58, Q12, Q13, J4
Back-end power board	J1, U23
Battery	

C.1.17 Z0601 LCD Monitor I2C Connection Test

- Test Content

The super stratum test item：Z0201 PC Module and MF FPGA Interconnection Test.
Check if the I2C communication serial port between the multifunction FPGA and LCD monitor. This item will open the screen-saver and then recover. Brightness of LCD will turn down and then recover.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally. The screen-saver of setting will be closed after shutting down.
2. Check LCD and then to see if there is the need to change digital board.

Board	Connector
Digital board	U21, J2

C.1.18 Z0602 Touch Screen LCD Monitor I2C Connection Test

- Test Content

The super stratum test item：Z0201 PC Module and MF FPGA Interconnection Test.
Check if the I2C communication serial port between the multifunction FPGA and touch screen LCD.
This item will open the screen-saver and then recover. Brightness of LCD will turn down and then recover.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally. The screen-saver of setting will be closed after shutting down.
2. Check touch-screen and then see if there is need to change the digital board.

Board	Connector
Digital board	J2, U54

C.1.19 Z0701 Keyboard USB Interconnection Test

- Test Content

Test if keyboard and USB port on the main unit can communicate normally.

- Suggestion when test failed:

1. Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally
2. First option is to change the keyboard board and then the digital board.

Board	Connector
Digital board	J1, J2
Keyboard board;	U27, J12

C.1.20 Z0702 Keyboard Key, Encoder, TGC, Trackball Function Test

- Test Content

The super stratum test item：Z0601 Keyboard USB Interconnection Test
It mainly tests whether the buttons, encoders, TGCs, trackball, backlight LEDs and indicating LEDs in the keyboard are normal, and reads board ID, keyboard FPGA and version of program.

■ Test Description

The keyboard testing interface is shown as follows:

Note: in V4.0 new keyboard is added, the self-diagnosis screen will detect the keyboard version automatically and present the corresponding screen. The screen for new keyboard is as follows.

As shown in the figure above, click [Start] to start the keyboard test. The controls in the simulation keyboard are corresponding to those of the real keyboard assembly.

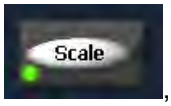
As for the buttons, press a button in the real keyboard and the corresponding button in the simulation keyboard blinks, which means the button is being tested. Changing in color means the button has being tested.

As for the trackball, roll the trackball in the keyboard and the cursor in the interface moves accordingly and the in the simulation keyboard blinks, which means the system has received data from the trackball and the trackball has being tested.

The encoder rotation test: the

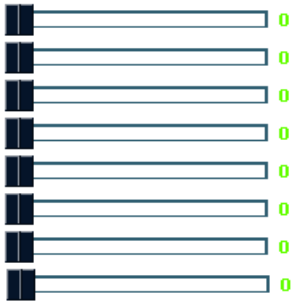
on the simulation keyboard corresponds to the encoder on the real keyboard. When you rotate the encoder in a direction, the corresponding green ball around the encoder on the simulation keyboard will rotate in the same direction. The encoder face will flicker and turn green or orange.

The encoder key test: when you press the encoder key, the encoder key on the simulation keyboard will change status accordingly, and flicker and turn green.

When you dial the 

, the control will change according to the direction of the slider with corresponding green light point the direction.

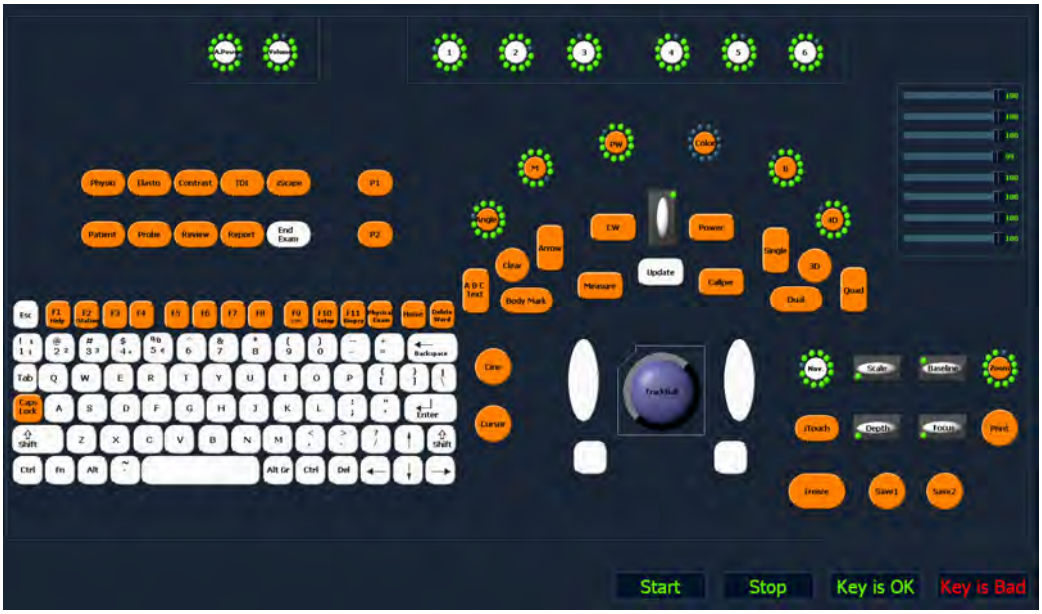
All controls which turn orange stand for corresponding keys having orange indicators.

TGC test: 8 TGC sliders on the keyboard correspond to 

controls on the simulation keyboard. When sliding TGC sliders on the keyboard, the corresponding controls on the simulation keyboard will move as well.

Keyboard backlight test: when the simulation keyboard initializes, all dual-color lights will highlight in green on the keyboard. When a key is being tested, the dual-color backlight will automatically turn orange after it is pressed.

After all tests for the keyboard assembly finished, the keyboard screen is shown in figure as below.



Note: the above figure is for old keyboard test result. If the machine uses a new keyboard, then the new keyboard backlights are only white after test, as follows.

In addition, there is a Arrow key on both the new keyboard and control panel, as long as you press one button, Arrow on the both keyboard and control panel will turn color and blink. For the first time, the key blinks in green, for the second time and furthermore, the key on the keyboard blinks in white and blinks in orange on control panel.

After the tests, if functions of the keyboard assembly are normal, click “Keyboard is OK”; otherwise, click “Keyboard is Bad”.

- Suggestion when test failed:

Check if the following listed hardware and the related circuits are normal, check if the interfaces are well welded and if the module is working normally

Board	Connector
Keyboard board	*U27, J12*
Digital board	*J1, J2*

C.1.21 Z0703 Keyboard Key and Trackball LED Test

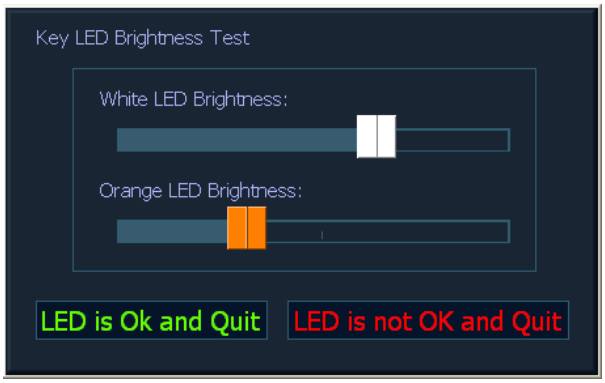
- Test Content

The super stratum test item：Z0601 Keyboard USB Interconnection Test.

It tests whether the button LEDs and trackball LED in the keyboard work normally.

- Test Description

The following dialog box appears when testing. Change the brightness of the white and orange LEDs respectively and check whether the brightness of LEDs on the keyboard change accordingly. Change the color of the trackball LED and check whether the LED on the keyboard changes accordingly. If the brightness of the keyboard LEDs and color of the trackball LED are the same as configured, click “LED is OK and Quit” to quit the dialog box. If not, click “LED is not OK and Quit” to quit the dialog box.



◆ Suggestion when test failed

1. Check if the hardware and related circuits listed below are normal, interfaces are securely welded, modules are normal.

Board	*Connector*
Digital board	*J1, J2*
Keyboard board	*U27, J12*

C.1.22 Z0801 PC Module and DSP Interconnection Test

■ Test Content

Test the PCIeX4 BUS between PC module and CBSP_UPLOAD FPGA

■ Analysis when test failed

First check if Windows can recognize the Ultrasound DataUpload Device, the malfunction has appeared ever. If the device can be recognized, there may be communication malfunction between DSP board and PC module.

◆ Suggestion when test failed

Replacing DSP board is recommended.

C.1.23 Z0802 DSP DDR Test

◆ Test Content

The super stratum test item：Z0702 PC Module and DSP Interconnection Test.

Test the all space reading &writing function of four types of DDR loading by DSP FPGA, output DSP buffer DDR(transferring DSP middle processing data),SCAN buffer DDR(transferring scan control frame) and I/Q buffer DDR(transferring I/Q) test result.

◆ Analysis when test failed

If test is failed, there may be connection malfunction between FPGA on DSP and plugging DDR, which will cause the data communication test item between receiving board/CW board and DSP board FAIL. The case appeared ever is that FPGA is destroyed in the installation process and cause the test FAIL.

◆ Suggestion when test failed

Check if the FPGA and DDR on DSP board are press-destroyed and well welded or installed.

C.1.24 Z0901 Transmitter Board A Slot ID Test

◆ Test Content

The super stratum test item：Z0702 PC Module and DSP Interconnection Test.

Check if transmitter board A is in place.

◆ Analysis when test failed

If prompt “A Transmitter Board Slot ID Test FAIL.”, transmitter board groove recognition may be failed, please check the recognition signal in cables of DSP board, transmitter board and communication mother board.

◆ Suggestion when test failed

Replace the transmission board A first to see if the problem is solved, then think about changing DSP board.

C.1.25 Z0902 Transmitter Board A and DSP Board Interconnection Test

◆ Test Content

The super stratum test item：Z0801 Transmitter Board A Slot ID Test.

Connectivity test between FPGA of transmitter board A and FPGA of DSP board.

◆ Analysis when test failed

If prompt “A Transmitter FPGA and DSP FPGA interconnection test FAIL.”，there may be malfunction in control BUS between FPGA of transmitter board A and FPGA of DSP board. please check the control BUS in cables of DSP board, transmitter board and communication mother board.

◆ Suggestion when test failed

Replace the transmission board A first to see if the problem is solved, then think about changing DSP board.

C.1.26 Z1001 Transmitter Board B Slot ID Test

◆ Test Content

The super stratum test item：Z0702 PC Module and DSP Interconnection Test

Check if transmitter board A is in place.

◆ Analysis when test failed

If prompt “B Transmitter Board Slot ID Test FAIL.”, transmitter board groove recognition may be failed, please check the recognition signal in cables of DSP board, transmitter board and communication mother board.

◆ Suggestion when test failed

Replace the transmitting board B first to see if the problem is solved, then think about changing DSP board.

C.1.27 Z1002 Transmitter Board Band DSP Board Interconnection Test

◆ Test Content

The super stratum test item：Z0901 Transmitter Board B Slot ID Test

Connectivity test between FPGA of transmitter board B and FPGA of DSP board.

◆ Analysis when test failed

If prompt “B Transmitter FPGA and DSP FPGA interconnection test FAIL.”，there may be malfunction in control BUS between FPGA of transmitter board B and FPGA of DSP board. please check the control BUS in cables of DSP board, transmitter board and communication mother board.

◆ Suggestion when test failed

Replace the transmitting board B first to see if the problem is solved, then think about changing DSP board.

C.1.28 Z1101 BF1 FPGA and DSP FPGA Interconnection Test

◆ Test Content

The super stratum test item：Z0702 PC Module and DSP Interconnection Test.

The connectivity test of control BUS between FPGA of DSP board and BF1 FPGA of receiving board. If the test is passed, logic version and compiling version of BF1 FPGA will be output.

◆ Analysis when test failed

If prompt “BF1 and DSP Interconnection Test(Control Interface) test FAIL”, there may be connectivity malfunction between FPGA of DSP board and BF1 FPGA of receiving board . please check the DSP board, receiving board and communication mother board.

◆ Suggestion when test failed

Replace the receiving board first to see if the problem is solved, then think about changing DSP board.

C.1.29 Z1102 BF1 FPGA and BF2 FPGA Interconnection Test

◆ Test Content

The super stratum test item：Z1001 BF1 FPGA and DSP FPGA Interconnection Test.

The connectivity test of control BUS between BF1 FPGA and BF1 FPGA of receiving board. If the test is passed, logic version and compiling version of BF2 FPGA will be output.

◆ Analysis when test failed

If prompt “BF1 FPGA and BF2 FPGA Interconnection Test(Control Interface) test FAIL;”，there may be connectivity malfunction between BF1 FPGA and BF1 FPGA of receiving board, please check the control bus before two FPGA.

◆ Suggestion when test failed

Replace receiving board is recommended.

C.1.30 Z1103 BF and DSP Interconnection Test (Data Interface)

◆ Test Content

The super stratum test item：Z1002 BF1 FPGA and BF2 FPGA Interconnection Test

The connectivity test of data BUS between FPGA of DSP board and BF2 FPGA of receiving board, also BF1 FPGA and BF2 FPGA.

◆ Analysis when test failed

If prompt “BF and DSP Interconnection Test(Data Interface) test PASS.”, there may be connectivity malfunction of data BUS between FPGA of DSP board and BF1 FPGA of receiving board. Or BF1 FPGA and BF2 FPGA . please check the DSP board, receiving board and communication mother board.

◆ Suggestion when test failed

Replace the receiving board first to see if the problem is solved, then think about changing DSP board.

C.1.31 Z1104 ATGC Function Test

◆ Test Content

The super stratum test item：Z1003 BF and DSP Interconnection Test(Data Interface).

Increase ATGC gain, collect noise value of all channels to judge if the RMS value can increase along with gain amplification.

◆ Analysis when test failed

If prompt “ATGC function test FAIL.”，there may be malfunction on gain adjustment circuit of receiving board

◆ Suggestion when test failed

Replace the receiving board is recommended.

C.1.32 Z1105 AFE Digital Interface Test

◆ Test Content

The super stratum test item：Z1003 BF and DSP Interconnection Test(Data Interface).

Let AFE enter test mode to transmit the data to FPGA of transmitter board, check if the AFE chip works normally.

◆ Analysis when test failed

If prompt “AFE digital interface test FAIL. AFE XXX Broken;”，there may be malfunction on AFE chip on receiving board. Please check the AFE chip.

◆ Suggestion when test failed

Replace the receiving board is recommended.

C.1.33 Z1106 Transmission and Reception Function Test

◆ Test Content

The super stratum test item：Z1004 AFE Digital Interface Test.

The connectivity test of 128 channels between transmission and receiving: only one channel transmitting 2V 1M PHV1 wave every time, analyze if the sampling wave is PHV1 wave and the Signal-to-Noise with another channel.

◆ Analysis when test failed

If prompt “Open circuit emit receive channel: XXX”，states the wave which is transmitted by XXX channel is incorrect. If prompt “Short circuit emit receive channel: XXX”，states XXX channel transmitting affect another channel.

◆ Suggestion when test failed

1. If prompt “Open circuit emit receive channel: XXX”. Please replace the receiving board first to see if the problem is solved, and then the transmission board.

2. if prompt “Short circuit receive channel: XXX”. Please replace the transmission board first to see if the problem is solved, and then the receiving board.

C.1.34 Z1201 Probe Board and Receiver Board Interconnection Test

◆ Test Content

The super stratum test item：Z1001 BF1 FPGA and DSP FPGA Interconnection Test.

Test the connectivity of SPI control BUS between probe board and receiving board ,output probe ID and logic version.

◆ Analysis when test failed

If prompt “Probe Board and Receiver Board Interconnection Test :FAIL”，there may be malfunction on SPI control BUS between receiving board and probe board.

◆ Suggestion when test failed

Replacing the probe board first to see if the problem is solved, and then the receiving board.

C.1.35 Z1301 CW Board and DSP Board Interconnection Test

◆ Test Content

The super stratum test item：Z1001 BF1 FPGA and DSP FPGA Interconnection Test

Test the connectivity of control BUS between DSP FPGA and CW FPGA, output CW board ID and logic version.

◆ Analysis when test failed

If prompt “CW Board and DSP Board Interconnection Test(Control Interface) test FAIL;”，there may be malfunction on control BUS between DSP board and CW board.

◆ Suggestion when test failed

Check CW board, communication mother board and DSP board.

C.1.36 Z1302 CW and DSP Interconnection Test (Data Interface)

◆ Test Content

The super stratum test item：Z1201 CW Board and DSP Board Interconnection Test

The connectivity test of data BUS between DSP FPGA and CW FPGA. The test data of I/Q is put into DDR on DSP by CW board, then is judged correct or not.

◆ Analysis when test failed

If prompt “CW and DSP Interconnection Test (Data Interface) test FAIL.”，check if the test item “Z0702 DSP DDR Test” is PASS，if FAIL，there may be malfunction on reading memory of DSP board; if PASS, there may be malfunction on data BUS between DSP board and CW board.

◆ Suggestion when test failed

First option is to change CW board, and then the DSP board.

C.1.37 Z1303 CW SPI Test

◆ Test Content

The super stratum test item：Z1201 CW Board and DSP Board Interconnection Test

The connectivity test of SPI BUS between CW FPGA and AFE.

◆ Analysis when test failed

If prompt “CW SPI test FAIL.”，there may be malfunction on SPI BUS between CW FPGA and AFE.

◆ Suggestion when test failed

Replacing the CW board is recommended.

C.1.38 Z1304 CW AFE Digital Interface Test

◆ Test Content

The super stratum test item：Z1203 CW SPI Test.

Test the function of AFE on CW board: let AFE enter test mode , send test data to CW FPGA, read the data to judge if it is correct or not.

◆ Analysis when test failed

If prompt “CW AFE digital interface test FAIL. AFE XXX Broken;”，states that the XXX AFE chip of CW board is failed, please check the AFE chip of CW board.

◆ Suggestion when test failed

Replacing CW board is recommended.

C.1.39 Z1305 CW ATGC Function Test

◆ Test Content

The super stratum test item：Z1204 CW AFE Digital Interface Test.

Increase ATGC gain, collect noise value of all channels to judge if the RMS value can increase along with gain amplification.

◆ Analysis when test failed

If prompt “CW ATGC function test FAIL.”，there may be malfunction on gain adjustment circuit of CW board.

◆ Suggestion when test failed

Replacing CW board is recommended.

C.1.40 Z1306 CW IQ Test

◆ Test Content

The super stratum test item：Z1204 CW AFE Digital Interface Test.

Set the transmitting output frequency be different from the receiving frequency. Then I/Q will get a fixed sine wave to judge if the function of I and Q route are normal.

◆ Analysis when test failed

If prompt “I route Test FAIL;Q route Test FAIL.”, there may be malfunction on I and Q route circuit.

◆ Suggestion when test failed

Replacing CW board is recommended.

C.1.41 Z1401 4D Driver Board ID Test

◆ Test Content

The super stratum test item：Z0701 PC Module and DSP Interconnection Test.

Check if 4D board is in place, read the ID of 4D board and logic version.

◆ Analysis when test failed

If prompt “4D Board is not on the site.”，states that the 4D board is not in place or in –place detection circuit is failed; if prompt “4D Driver Board logic version and board ID read error.”，there may be communication malfunction between 4D board and DSP board.

◆ Suggestion when test failed

Replacing 4D board is recommended.

C.1.42 Z1402 4D Driver Board Driver Circuit Test

◆ Test Content

The super stratum test item：Z1301 4D Driver Board ID Test.

Set the Sin+ and Sin- driver circuit to output sine signal . after amplification ,AD will sample the signal to judge the frequency and amplitude .Also include Cos+ and Cos- driver circuit.

◆ Analysis when test failed

If prompt “Sin+ Cos+ Sin- Cos- driver circuit test FAIL.”，there may be malfunction on driver circuit.

◆ Suggestion when test failed

Replacing 4D board is recommended.

C.1.43 Z1403 4D Driver Board Programmable Voltage Test

◆ Test Content

The super stratum test item：Z1301 4D Driver Board ID Test.

Set the program high voltage PVPP and NVPP to output corresponding voltage, AD will sample the voltage to judge the amplitude after amplification.

◆ Analysis when test failed

If the test is FAIL，the theory value and sampling value of PVPP and NVPP will be prompted. You may judge which power channel signal is failed according to the values.

◆ Suggestion when test failed

Replacing 4D board is recommended.

C.1.44 Z1501 ECG Module Information Read Test

◆ Test Content

The super stratum test item：Z0701 PC Module and DSP Interconnection Test.

Check if ECG board is in place and read ID of ECG board, logic version and software version.

◆ Analysis when test failed

If prompt “ECG Module is not on the site.”，states that ECG is not in place or in-place detection circuit is failed; if prompt “ECG Module information read test FAIL.”，there may be communication malfunction between ECG board and DSP board.

◆ Suggestion when test failed

Check if ECG board, back-end mother board, DSP board and digital board. First option is to change ECG board.

C.1.45 Z1502 ECG Module Self Test

◆ Test Content

The super stratum test item：Z1401 ECG Module Information Read Test.

Check if ECG board is in place, send order to let the ECG do self test and waiting the feedback order.

◆ Analysis when test failed

If prompt “ ECG Module is not on the site.”，states that ECG is not in place or in-place detection circuit is failed; if prompt “ECG Module self test FAIL;”，there may be malfunction on ECG board.

◆ Suggestion when test failed

Replacing ECG board is recommended.

P/N: 046-002357-00 (V11.0)